MASTER PLAN

(2010-11 to 2019-20)

NANDANKANAN ZOOLOGICAL PARK

FOREST DEPARTMENT

GOVERNMENT OF ORISSA

Prepared by:

Dr. Sudarsan Panda, IFS

Director, Nandankanan Zoological Park

NANDANKANAN

Preface

Nandankanan Zoological Park is one of the finest large zoos of the country and it spreads over an area of 362 ha. Nandankanan houses a number of free living animal species, besides, 118 species of zoo animals. The zoo which was established on 29th December, 1960 has now attracted more than 2.1 million visitors a year. Nandankanan enjoys a special place for *ex-situ* conservation of wildlife. It is also a vibrant centre for environment education. Nandankanan has the unique distinction of integration of wildlife conservation both in wild and in captivity. The animal enclosures have been progressively designed to create large enclosures in natural environment. There is a zoo hospital to monitor and provide health care of animals on day to day basis. A number of rescued and injured animals have been provided necessary health care and are rehabilitated. The State Botanical Garden spread over 75 ha. adjoining to the zoo has been handed over to Nandankanan management since August, 2006. This is one of the important plant conservation and nature education centre of the State. Nandankanan Zoological Park has an important wetland of National importance namely Kanjia lake. The Zoological Park together with Kanjia lake and Botanical Garden has been declared as Nandankanan Wildlife Sanctuary over an area of 4.37 sq. km. (notified on 3rd August, 1979).

It is the mandate of Central Zoo Authority and National Zoo Policy to have a long term Master Plan for zoos in India. A Master Plan sets the vision for the future of the zoo and sets out a blue print of actions to achieve various objectives of zoo management. The first master plan was prepared by Sri Saroj Raj Choudhury in the year 1967. The first integrated master plan for Nandankanan Zoological Park was prepared by Sri S.K. Pattnaik and Sri Vinod Kumar in 2001 which was approved for a period of 20 years. However to maintain uniformity for preparation of master plan for development of Indian zoos, the Central Zoo Authority in 2008 issued guidelines. The present Master Plan is a comprehensive document giving a detail road map for next ten years (2010-11 to 2019-20) regarding development, improvement and up-gradation of facilities and infrastructures available in the zoo as well as capacity building of zoo personnel for effective zoo management. The present plan is based on concept plan approved by the Central Zoo Authority for Nandankanan. Some of the

new innovations proposed in the Master Plan include establishment of butterfly park, amphibian park, herbivore safari, interpretation centre and zoo education centre. I am hopeful that at the end of the plan period of the present Master Plan prepared for Nandankanan Zoological Park, all the objectives will be effectively achieved.

I would like to place on record the contribution of Sri Arun Kumar Mishra, Assistant Director, Nandankanan for preparation of the Master Plan. I would also like to acknowledge the contribution of Sri S.N. Mohaptra, IFS, Deputy Director for his valuable help for preparation of the plan. I would like to express my sincere gratitude to Sri S.K. Pattnaik, IFS (Retd.) former Chief Wildlife Warden, Orissa and Dr. L.N. Acharjyo, Former Zoo veterinarian, Nandankanan for their contribution and guidance during preparation of the Master Plan.

I would like to gratefully acknowledge the valuable contributions made by Sri P.N. Padhi, IFS, Principal Chief Conservator of Forests (WL) & Chief Wildlife Warden, Orissa. I would like to express my gratitude to Sri U.N. Behera, IAS, Principal Secretary, Forest & Environment Department, Government of Orissa for his valuable inputs in preparation of the Master Plan. My hearty thanks are due to Sri S.S. Srivastava, IFS, Chief Conservator of Forests (WL) for his valuable suggestions. I would like to express my sincere thanks to Sri Satyanarayan Mishra, Junior Research Fellow, Nandankanan Zoological Park and Sri Akshaya Kumar Das for computerization and design of the present Master Plan. I would like to convey my thanks to all the Range Officers, Zoo Veterinarians and the employees of Nandankanan who have contributed for the preparation of the document.

Bhubaneswar

(Dr S. Panda) 10.5.10
Director
Nandankanan Zoological Park

DIRECTOR
Nandankanan Zoological Park
Bhubaneswar,

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Executive summary

Nandankanan Zoological Park (NKZP), one of the premier large zoos of the country is situated amidst natural forest along the banks of Kanjia Lake in the State of Orissa. It is located between 20^0 23' 08" to 20^0 24' 10" North latitude and 85^0 48' 09" to 85^0 48' 13" East longitude (Survey of India Toposheet No. 73 H/15-NW). The park started with few animals as a small zoo in 1960 but gradually transformed into a large zoo over the period of time. Animals collected from different parts of the State were sent to the World Agriculture Fair organized in New Delhi in Jan-Feb, 1960. After the fair, the animals were kept at Khandagiri temporarily. Due to water scarcity, it was thought of relocating the animals at some convenient place and thus the present location was selected and NKZP was established on 29th December, 1960. The park spreads over 362.1 ha and comprises of vast expanse of undulating topography with natural forest, water bodies and other natural features which help the inhabitants of the park to live in a habitat close to their natural conditions.

The first master plan was prepared for the NKZP in 1967 for a period of 20 years. In August, 1979 NKZP was declared as a wildlife sanctuary. An integrated master plan was prepared in 2001 for 20 years. The present Master Plan is a comprehensive document giving a detail road map for integrated development & management of NKZP for next 10 years i.e. 2010-11 to 2019-20

The first successful captive breeding of gharials in the world was achieved in NKZP in 1980. In the same year, the first litter of white tigers were born to normal coloured parents for which NKZP became world famous. Then the successful breeding of other indigenous as well as exotic species continued. Over the years as a result of various initiatives, Nandankanan has emerged as a vibrant centre for wildlife conservation in the country.

1. Mission and objectives of the Nandankanan Zoological Park:

1.1 In the recent past there has been a paradigm shift in the zoo management globally. To keep pace with the modern zoo management, the NKZP has also undergone significant changes. The priority of the zoo has been changed with more emphasis on conservation, education and research over recreation. The park spreads over an area 362.1 ha including a natural water body of 66.1 ha. The mission and objectives of NKZP are indicated below.

1.2 The mission of NKZP is to; achieve the distinction of an outstanding Zoo through world class Conservation, Education, Research and exciting visitor experience by connecting people to biodiversity conservation.

1.3 Objectives

i. To made conservation breeding of various species with emphasis on endangered species belonging to the region for preservation of biodiversity.

ii. To facilitate research and scientific study on animal behaviour, enclosure enrichment, feed and nutrition and reproductive biology.

iii. To prmote education and awareness amongst visitors towards conservation of wildlife

iv. To ensure housing of captive animals and birds with special emphasis on health care, ethical standards, animal welfare and excellent animal husbandry.

v. To provide holistic environment for rehabilitate of wildlife including leopard, sloth bear and monkeys.

2. Achieving the stated objectives:

The above objectives are proposed to be achieved by housing and displaying broad representative of endangered animals and birds with emphasis on species belonging to the region considering the climatic condition.

3. Proposed future action plan:

The present action plan is aimed to provide planned development of the park for coming 10 years i.e. 2009-10 to 2018-19. The proposal is based on the topography of the site, water availability, vegetation, climate, visitors profile, conservation, education & research needs and convenience of management. The recommendations of the Central Zoo Authority during the evaluation of the park from time to time has also been kept in view while formulating the proposal for new structures or modification of existing structures. More emphasis has been given for consolidation of the present situation rather than to expand in the form of too many new exhibits. However, care has been taken to ensure that the areas already crowded with exhibits will not not be further congested.

3.1. Animal Section:

The animal section is the most important part of any park. For locating the enclosure, various aspects like topography and vegetation needs to be kept in mind for different species depending upon their habits. Adequate care has been given to provide adequate space to the exhibited species in new enclosures and also for those which need to be redone or modified.

The maximum number of any species to be displayed would depend on their social behavior based on which adequate space for the individual or social group would be provided. The enclosure should be designed to take care of the biological need of the species with carefully planned enclosure enrichment, its safety and proper viewing by the visiting public.

While attempts shall be made to provide open-air enclosures for most of the species with dry or wet moat barrier, other types of barriers like chain link mesh fence, glass or wall shall be used wherever felt more appropriate.

All enclosures shall be designed in a manner to provide adequate protection to the animals against climatic variation to commensurate with the individual need of the species with appropriate enclosure enrichment. Adequate attention will be paid for provision of kraals or isolation arrangements for protecting individuals or groups from aggressive behavior of individuals in the group, protection of pregnant, injured animals and young ones. Such separation will help in elimination of any problem of infighting, cannibalism or rejection.

Altogether the NKZP has animal collection from different regions of the country and from other continents of the world. It is proposed not to display them as per their geographical distribution. It is proposed to adopt broad taxonomic display for convenience of management, research and education. The broad classification for display would be as follows-

a) Large carnivores like tigers, leopards, lions, bears etc.
b) Large mammals like elephants, hippopotamus, rhinoceros etc.
c) Small carnivores.
d) Other small mammals like rodents, marsupials etc.
e) Nocturnal animals.
f) Ungulates
g) Primates
h) Reptiles including crocodilians
i) Water birds
j) Terrestrial birds including dirds of prey
k) Flightless birds
l) Aviary birds (small birds)
m) Fishes
n) Amphibians
o) Invertebrates

The location of this open air zoological park is ideally situated to breed and exhibit various Indian species. Recognizing the importance of large zoos in providing nature education as well as their role in scientific research on different aspects of wild animals, emphasis has been

given to display Indian fauna with special reference to those belonging to the region. Considering the conservation importance of some little known small mammals like Indian pangolin, ratel, mouse deer, flying squirrel and different species of snakes needs to be included in the collection plan and be exhibited. The NKZP has the past experience to handle these animals species of the region and they paly significant role in education as these endangered species being more secretive, are rarely sighted in the wild. The NKZP at present has many exotics. However, exotic species like giraffe, zebra, hippo, puma, African lion, large apes, kangaroo, flightless birds, macaw, cockatoo etc. may be exhibited for their peculiar morphological characters. They are quite popular among the visitors and are easier to handle. Most of the domestic species earlier housed in the zoo have been phased out and the remaining ones should not form part of animal collection any longer. However, top priority shall be given to pair the single animals or animals of the one sex available in the zoo either by arranging mates for them or by transferring to other zoos on breeding loan or transfer in the interest of conservation of the species. This is very urgent in the case of endangered species of Indian sub-continent.

A rigorous exchange programme with other zoos will be planned and executed during the plan period for improvement of genetic status of different species and also to prevent inbreeding. A herbivore safari is proposed to be established during the plan period. It is also proposed to establish a Butterfly Park and an Amphibian Park during the period of current Master Plan.

3.2. Conservation breeding

The zoo houses several endangered species of regional significance that include three species of Crocodilians (Gharial, Mugger and Salt water crocodile), Indian Pangolin, Ratel, Mousedeer, Sambar, Blackbuck, Tiger, Leopard, Small Indian Civet, Brahminy kite, Vultures, Indian peafowl, Storks, Hill mynah, Sloth bear, Elephants, Barking deer, species of Owl, a variety of snakes, monitor lizards, fresh water turtles etc. Other species in the zoo include Rhinoceros, Browantlered deer, Swamp deer, Himalayan Black bear, Liontailed Macaque, Nilgiri langur etc.

NKZP has been a premier conservation institution with its unique ability and commitment to effective ex-situ conservation of wildlife. Conservation breeding has been the major thrust of NKZP. It has the unique distinction of setting up the captive breeding center where **Gharials** were bred successfully in captivity in 1980. More than 700 Gharial successfully reared in the breeding center of NKZP have been released in their natural habitat of Orissa. It has the distinction of producing **white tigers** from normal coloured parents in the world. NKZP is

globally known for its white tigers. It has also the distinction of captive breeding successful rearing of highly threatened species like **Indian Pangolin** (*Manis crassicaudata*). NKZP is identified as the coordinating zoo for breeding of Indian Pangolin by Central Zoo Authority (CZA). The park is also identified as the participating zoo for breeding of Tiger and Mousedeer.

The zoo is all set to establish a whitebacked vulture conservation breeding centre. This is going to be a major challenging task for the park. The population of White-backed vulture has declined by more than 97% in nature. It is apprehended that unless assisted breeding of the above species is adopted then there is every possibility that it may become extinct from the nature. Central Zoo Authority have approved the proposal for setting up of the vulture conservation breeding center for whitebacked vulture (*Gyps bengalensis*) at NKZP. Funds are being released and the center would be set up in collaboration with the Bombay Natural History Society very soon.

The other important suggested for captive breeding are leopard, elephant, browantlered deer, liontailed macaque, blackbuck with emphasis on the small mammals like Indian pangolin and mousedeer, amongst mammals; gharial, saltwater crocodile, water monitor lizard amongst reptiles. Amongst exotics species like zebra, hippopotamus, chimpanzee, hamadryas baboon, cockatoos, emu etc shall be a part of the captive breeding programme. To achieve sustainable *ex-situ* conservation objectives, emphasis would be laid on animal welfare, health care, ethical standards and excellence in standards of animal husbandry with emphasis on enclosure enrichments and to inflict least human imprinting.

3.3. Modification or renovation of existing enclosures:

A number of enclosures which were constructed much earlier are very old and do not confirm to the modern concept of park design. Some of them shall be completely demolished or few others shall be renovated to meet the specifications recommended in the Recognition of Zoo Rules, 1992. These rules and further guidelines of CZA shall be scrupulously followed while designing new enclosures or renovatying the existing enclosures.

The area earmarked for Conservation Breeding of Indian Pangolin and White backed Vulture are situated in the off display area within Nandankanan sanctuary and are adequately screened to prevent disturbance and human contact.

3.4. Construction of new enclosures:

Since certain species are highly specific in respect of their food and shelter, the housing in a few cases need more space for their naturalistic display as well as to meet their behavioural needs.

Some new enclosures are needed to be added following the appropriate enclosure design with appropriate environment enrichment.

3.5. Aquarium

A zoo aquarium was set up in collaboration with Centre for Environmental Education, Ahmedabad with well researched education materials. The objective of the aquarium is to educate the visitors about the threats to our aquatic ecosystem and about their conservation needs.

3.6. Amphibian exhibits

Considering the present crisis of Amphibians an amphibian exhibit is proposed to be established adjoining to Kanjia Lake. The basic objective of the exhibit would be to make the visitors aware about amphibians and how amphibians are an integral part of our ecosystem. It will also help in creating awareness amongst the visitors about their need for conservation.

3.7. Butterfly Park

Eighty five species of butterflies have been documented in NKZP. It is proposed to establish a Butterfly Park over one acre of land near proposed Wallby enclosure.

3.8. Herbivore Safari

Herbivore safari will be established over an area of 34 ha inside NKZP near the Western end of the park. Various herbivore species including spotted deer, sambar, barking deer, nilgai etc. will be displayed in their natural environment. Grasslands, water holes, fodder plants and other requirements of the species will be made available for the animals. The surplus herbivore population available in the zoo will be released in proposed Herbivore Safari.

3.9. Phasing out of surplus animals:

There were many domestic species which are on display in the zoo. Some of them have already been phased out, but few remaining animals need to be phased out as per the guidelines issued by Central Zoo Authority vide their letter No.19-64/92-CZA(212)(Vol.VIII)(M) dt. 17.09.2004. These animals are kept off exhibit and would be phased out soon.

3.10. Health Care

To provide excellent health care to the animals, there are three veterinary surgeons with required number of supporting staff who look after the day to day health status of the animals. There is a well equipped zoo hospital with adequate infrastructures necessary to monitor and provide best possible health care to the captive animals. The present Veterinary Hospital has a dispensary

room, a laboratory, X-ray unit, operation theatre, isolation ward and quarantine, beside a post-mortem and carcass disposal unit have been eastablished away from the veterinary hospital and animal display areas within its campus. Some additional amenities need to be provided to make the hospital responsive to all the immediate needs of animal health care. Health monitoring is carried out on daily basis. Periodic vaccination and deworming protocols are followed meticulously. Five members **"Technical Committee"** constituted by the state government who regularly monitor and review the health care management and related matters. The committee meets at regular interval to take stock of the situation. A close liaison is maintained with the Orissa Veterinary College (OVC) and the services of **"Health Committee"** from OVC is requisitioned whenever found necessary. A MOU is signed with the OVC to make the captive use of the **"Regional Centre for Wildlife Health"** functioning at Orissa Veterinary College, Bhubaneswar established with the funding support from CZA.

3.11. Feed

Quality feed is very important in management of the captive animal in a zoo. To achieve this a **captive slaughter house** is made operational in the zoo campus to provide quality and fresh meat to the carnivore with proper antemortem and postmortem screening of the animals slaughtered daily. In addition to this to provide quality fodder to the herbivores a **captive fodder farm** is developed to achieve self sufficiency. Although the zoo has achieved self sufficiency in supply of green fodder farm 33 Ac. captive fodder farm, yet the problem of supply of tree fodder (ficus sepecies) has not been materialized. In order to achieve self sufficiency in tree fodder, there is urgent need to take up plantations of ficus, bamboo, tree mulberry, subabul and other edible fodder trees inside the park at convenient places viz. Fodder farm, deer park, safaris, moated elephant enclosure and Botanical garden etc.

4. Personnel Policy for NKZP

The assessment of the personnel required for smooth management of the zoo is reviewed and assessed periodically. Accordingly, staff strength for the zoo is sanctioned from time to time. As the zoo graduated from a small zoo to a large zoo, from small area of holdings to large areas, from small number of animal species and population to more than 118 species and over 1400 population size, the requirement of personnel of different categories increased steadily. At present, the Director of the zoo is of the rank of Conservator of Forests. He is assisted by one Deputy Conservator of Forests, designated as Deputy Director with effect from 2003 and one Assistant Director of the rank of Assistant Conservator of Forests. In addition to this, one Senior

Veterinary Officer of Class-I rank and two Veterinary Assistant Surgeon and have been deployed in the zoo for veterinary care. The recruitment rule for Grade A,B,C & D category of staff are as per State Government and Central Government rules. The present grade wise staff strength of the zoo is as follows:

Grade of staff	Sanctioned strength	Staff in position
A	3	3
B	10	10
C	77	50
D	75	57
Total	**165**	**120**

A zoo Manual was introduced years back and the same needs amendments and up-gradation. The regular staff manage and operate the park. In addition to the regular staff, there are 130 labourers engaged on continuous basis (under EPF scheme from 1974) for assisting and maintaining multifarious activities of the Zoological Park.

The Expert Committee on zoos constituted by Government of India in 1973 had recommended staffing pattern at Nandankanan as per B category zoo. As per norms of the Central Zoo Authority, the NKZP is at present placed in the category of Large Zoo(s). Due to sharp rise in the number of visitors to the zoo and expansion programme taken up from time to time by adding new enclosures, visitor facilities etc. it is becoming difficult to manage the zoo efficiently with the existing personnel. It is proposed to out source some of the activities in form of visitors amenities like boating, parking of vehicles, running of toy train, aquarium, sanitation work, maintenance of lawn and garden, operation of toilets for better and efficient management. This will reduce the burden on the zoo authorities and increase in the revenue collection which is being ploughed back for execution of developmental activities. Most of the grass root level staffs are quite old and illiterate. Although many staff over the years have been trained in zoo keepers training course, yet there is lack of adequate number of quality keepers with dedication. The zoo needs to have well trained and specialized trained personnel on a sustained basis to meet the standards set by modern zoo globally. The officials both veterinary and management side need to attend various training courses/workshops/seminars organized by CZA, WII and Indian Zoo Directors Association from time to time.

All the existing vacant posts need to be filled up in a phased manner to infuse fresh talent to the pool of zoo keeping staff. Two biologist need to be engaged urgently to take up various research and data keeping works.

5. For holistic and integrated development of entire Nandankanan complex the following aspects need special attention.

5.1. Security- The existing security system is managed by a Range Officer, one Forester, one Forest Guard and about 25 Employee Provident Fund register staff. The staff are quite old and they are not able enough to protect the porous boundary in eastern side. The local villagers often sneak into the park by scaling the laterite boulder stone wall for collection of firewood etc. It is proposed to complete laterite stone wall along eastern boundary for preventing entry of cattle and unscrupulous people. The existing patrolling road need to be improved and made all weather roads. It is proposed to engage private security personnel round the clock in three shifts to strengthen patrolling duty. One suitable patrolling vehicle need to be provided to ensure proper protection. Since the zoo is vulnerable to poaching due to the presence of large number of free ranging wild herbivores and other wild animals, it is proposed to have one watch tower in existing deer park and one behind lion safari. The order of Hon'ble High Court, Orissa for restricting all building and reclamation activities within 1 km. radius of NKZP need to be implemented scrupulously. It is strongly recommended to strengthen the existing zoo boundary wall by increasing the height and fixing barbed wire above the laterite stone wall.

5.2. Electricity supply- There is frequent power interruption and low voltage problems in the park at present. The existing power supply is being upgraded by providing a dedicated feeder from 33 KV line and by installing of transformers of 250 KVA. Further it is also proposed to lay underground cables to avoid electrocution and other ancillary problems. The proposal envisages the future power requirement of the park for next 20 years.

5.3. Water supply- At present the water requirement of the zoo and staff colony is being made from Kanjia lake, one deep well and two dug wells. Since the old pipe lines have been damaged and leaking profusely at many points, it is proposed to lay down PVC pipes with alternate arrangement for supply of water to various enclosures, water moats, toilets, drinking water points, gharial pool inside animal enclosures, aquarium, staff colony etc. One chlorination plant has already been installed to supply safe drinking water to visitors and animals. In future for maintaining vast tracts of landscaping unit, separate arrangement from Kanjia lake to be ensured. Some large storage tanks are to be constructed to store sufficient water to mitigate exigencies in tiger enclosures, quarantine, zoo hospital, herbivore enclosures, reptile park and nocturnal animal house. It is proposed to install heavy duty aquaguards-cum-coolers, water purifiers for providing quality water to visitors.

5.4. **Drainage & Sewerage system**- A separate master plan for proper drainage system for the entire zoo is to be drawn up with experts in that field. There is no systematic drainage and sewerage system inside the zoo at present which possess potential threat during heavy rains and cyclones.

5.5. **Ticket checking gate**- The existing ticket checking method is not a full proof method for preventing revenue pilferage. Although CCTV cameras have been fixed in booking counters, Gate complex and ticket checking gate yet the staff are devising new methods from time to time to overcome security checking. Therefore it is proposed to introduce bar-code system and engaging private agencies to prevent leakage of revenue and to further strengthen the security system. For entry of staff modern methods viz. ID card system, touch screen for recording timing of entry and exit of staff etc. can be introduced.

6. **Modern interpretation centre**- It is proposed to set up one modern interpretation centre within the premises of NKZP which will depict the biodiversity of the park and highlight the conservation breeding programme, research and education activities carried out in the zoo. DIORAMAS, animal trophies etc. would be displayed within a naturalistic environment.

7. **Zoo school**- Imparting conservation education for school and college students is the mandate of modern zoos. There is no dedicated zoo school building to carryout systematic school programmes. The Zoo school will be equipped with a mini theatre for wildlife film viewing, imparting education, LCD system and other modern amenities. It is proposed to engage a zoo education officer on contract basis to carryout zoo school programme.

8. **Relocation of staff colony**- The existing staff colonies are creating great disturbance to the tranquility of the park. Therefore, it is proposed to shift the staff colony to outside the park behind Nandankanan High School. The proposed site would be developed with all necessary amenities including housing, water supply, electricity, approach road etc. This would greatly reduce the disturbances and also provide better habitat condition for its wild denizens.

9. **Relocation of police station outside the zoo**- The existing police out-post inside the park is also creating disturbance. It is proposed to relocate the same near Jagannath chhak just outside the zoo boundary. This would facilitate better maintenance of law and order in and around the park.

10. **Closure of public thoroughfare inside the park**- One main road running from Jagannath chhak to cattle bridge in the heart of the park is being used as public thoroughfare since inception of the park. This creates immense disturbance for maintaining safety and

security of the park. A proposal has been sent to State Government for providing alternate road to the villagers outside the park so as to enable the park authority to close down the existing thoroughfare running inside the park.

11. **Establishment of modern toilet complex**- The existing toilet facilities are neither good nor being maintained properly. Modern pay toilet complexes under public private partnership need to be constructed and maintained. The toilet complex must cater to all classes of visitors including disabled persons.
12. **Improvement of food court and cafeteria**- Since zoo is attracting more and more number of tourists, the existing restaurant and canteen run by Orissa Tourism Development Corporation (OTDC) is not adequate. Efforts are being done to renovate the existing cafeteria and food court at strategic locations to cater the demand of visitors.
13. **Development of the parking complex**- The existing parking facility has been developed recently and is privatized for better management. However, the existing parking area needs further development to have a state of art parking complex with all modern amenities including enhancing the capacity to accommodate more vehicles in future.
14. **Upgrading data base**- In order to upgrade the data base, it is proposed to develop ZIMS (Zoological Information Management system) in Nandankanan zoo. Web based application will allow all users to access animal collections data in real-time from any authorized computer any where in the world. in order to maintain stud book or to maintain species management software SPARKS (Single Population Analysis & Record Keeping System) can be used. There can be ARKS (Animal Record Keeping System) used for institutional animal record keeping. Further updated REGASP (Regional Animal Species Collection Plan) files are to be submitted to the Central pool to aid regional collection planning. Therefore use of computers, internet, use of various software must be considered seriously for upgrading our data base.
15. **WAZA** - Nandankanan Zoological Park is the first zoo in India to become a member of **World Association of Zoos & Aquaria (WAZA)**. It is also a member of International Special Information System (ISIS) network. NKZP has launched Adopt-an-animal scheme. The park has the distinction for creating the first captive breeding facility for endangered gharials and Indian Pangolin. The park has the distinction of publishing highest number of research papers on captive zoo animals in India.

PART-I

CHAPTER-I

INTRODUCTION

1.1 Preliminary

The very name of "Nandankanan", in mythology, delineates the ecstatic but imaginary beauty of the celestial garden. It also indicates the real beautiful spots par excellence on earth, where one can see the panoramic views of nature and appreciate the glamour that exists in the external morphology of plants and animals.

Nandankanan was established in the year 1960 on the outskirts of the then newly developing township of Bhubaneswar after a search for a suitable location in Chandaka Forest complex with natural forest cover. This site covers a portion of Krishnanagar and Jujhagarh Demarcated Protected Forests (DPF) and a beautiful natural lake called "Kanjia" close to Barang Railway station on Howrah-Chennai route.

Nandankanan, the first Zoological Park of the state started with a few animals, but the vision was to bring it to prominence &elevate it to the position of a major zoological park in the country. Late Saroj Raj Choudhury, who headed the zoo for sometime prepared the first Master Plan for the NKZP in August, 1967. The tenure of the plan was for the period of 20 years. The plan was implemented to a great extent & several new activities were taken up in the zoo based on the recommendations of the master plan.

In 1972, a 5-year plan was prepared by Sri R. Mishra, the then Wildlife Conservation Officer. Further developments in the zoo were taken up as per the recommendations of this plan. A Zoo Expert Committee set up by the Government of India, visited this zoo on 24-25th August, 1973 and categorized this as a "B" Class zoo. In 1977, Sri S. Mohapatra, the then Wildlife Conservation Officer prepared a plan indicating future proposed developments in the zoological park and there was time limit set for the said development. Funds always continued to be a constraint for large scale improvement and developments. This was followed up by 5 years Conservation and Management plan for Nandankanan Sanctuary prepared by Sri Ch. G. Mishra. The Zoological Park became a part of the sanctuary notified in August, 1979. Subsequently, developments took place with periodical / annual plans prepared from time to time and submitted

to Government. After 1987, activity wise plans were also prepared and implemented for the White Tiger breeding project, Lion Safari, White Tiger Safari, Reptile Park etc.

There have been quantitative developments in Nandankanan over past 49 years in animal collection and housing as well as infrastructure development. Several new projects like Lion Safari, White Tiger Safari, Nocturnal Animal House, Reptile Park, Boating facility, Ropeway, Orchidarium, Aquarium, Toy Train, Nature Trail etc were taken up. However, the super cyclone which passed over the zoo on 29-30th October, 1999, struck a deadly blow and damaged many structures, uprooted large number of trees and resulted in death of many animals. The park was closed for the visitors from 29th October, 99 to 20th April, 2000. Sudden death of thirteen tigers in June-July, 2000 due to "Trypanosomiasis" outbreak and other reasons were the other sad occurrences which focused national attention on this zoo. The said catastrophe has created an opportunity for development of the zoo on modern lines. Funds have also been received from the Central Zoo Authority, 11th Finance Commission and State Govt. for all round development of the zoological park.

1.2 Necessity of a new master plan- The earlier approved master plan was prepared by Sri S.K. Patnaik, the then Chief Conservator of Forests (Wildlife) & Chief Wildlife Warden, Orissa and Sri Vinod Kumar, former Director, Nandankanan Zoological Park for the period 2001 – 2020. In order to maintain uniformity for preparation of master plans for Indian zoos, the CZA (Central Zoo Authority) issued guidelines for preparation of master plan for development of zoos in 2008. The new master plan would be a comprehensive document giving a detail road map for next ten years (2009-10 to 2018-19) regarding development, improvement and up gradation of facilities and infrastructure available at the zoo and building up of capacity for carrying out all the operations forming part of the zoo management with greater efficiency. Priority areas which have been given special attention in the new master plan are:

I. Achieve highest standards of housing and upkeep for zoo animals with a view to establish self sustatining populations of genetically and behaviourally viable animals adapting latest skills of behavioural enrichment and genetic management.
II. Planned breeding of endangered species in off exhibit area with requisite specification and with a viable breeding population
III. Developing requisite expertise for upkeep and health care of animals for their long term survival in captivity

IV. Thematic display of animals in nature immersion exhibits with appropriate feeding and housing facilities congenial to the species specific behaviour of the animals.

V. Assessment of carrying capacity of the zoo in respect of visitors keeping in mind the animal welfare, availability of the space, noise pollution, physical disturbance etc. by the visitors etc.

VI. Planning the visitor circulation in the zoo

VII. Development of appropriate signages and interpretation facilities

VIII. Efficient waste disposal system and sanitation practices for maintaining hygienic and clean environment in the zoo

IX. Designing and maintaining high standards of public facilities and civic amenities.

X. Developing effective management plans to deal with unforeseen contingencies and natural disasters including high influx of visitors on particular days.

1.3 History

A number of wild animals were collected from different parts of the state for the World Agricultural Fair organised in New Delhi in Jan-Feb, 1960. After the end of the Agricultural fair, the animals were brought to Orissa in May, 1960 and housed near Khandagiri for display. Water scarcity was the main problem in this location and it was then decided to establish a Zoo as there was no zoo in the State by that time.

The then Chief Minister, Dr. Hare Krushna Mahatab and the Minister for Development Dr. Radhanath Rath along with senior forest officials tried to locate a suitable site for establishing a zoo with good water source. The State capital had shifted partly to Bhubaneswar from Cuttack, a decade back and construction activities for the city was going on. After search for suitable area, it was found that a stretch of forest in the then famous Chandaka forest contain a good natural water body called Kanjia lake. This was close to the Barang Railway Station. It was decided to establish the zoo there taking part of Jujhagarh and Krishnanagar Demarcated Protected Forest (DPFs). Pursuant to the decision construction activities were taken up over a very small area to house some herbivores like Cheetal, Sambar, Barking deer and a few birds.

On 29th December, 1960, Sri S.K. Patil, the then Minister of Food and Agriculture, Govt. of India inaugurated the new Biological Park named "Nandankanan" which means the heavenly garden of God. Subsequently, in the year 1963 a Botanical Garden came up adjoining to the park in the other side of Kanjia lake. The Nandankanan Biological Park subsequently in 1980's was renamed as Nandankanan Zoological Park on recommendation of the Orissa Legislative

Assembly Committee on Estimates, 1981-82. The zoo started growing slowly with addition of new enclosures. The first tiger was brought to the zoo in the year 1964 from the Alipore Zoo in Calcutta along with a pair of African lions, a puma and a pair of muggers during All India Congress Committee session at Bhubaneswar. In 1967, the first open air tiger enclosure was constructed in the zoo and it surprised everybody that the last surviving tigress in Chandaka forest was lured on the 04th January, 1967 into this enclosure, where a male tiger "Pradeep" was already housed. She was named "Kanan" by the zoo officials. Proximity to wilderness has led to another interesting incident in 1964, when a courting wild tusker kidnapped a cow elephant from the zoo. However, the cow elephant returned to its enclosure later.

Nandankanan attained distinction in first ever breeding of the Gharial in captivity in a naturalistic pool created for the purpose, through a full grown male gharial brought from Frankfurt zoo 24 Gharials hatchlings hatched in the artificial hatchery created for incubation of 25 gharial eggs on 7th May, 1980. In the same year, 2 normal coloured tigers 'Deepak and Ganga' gave birth to 3 white off-springs named 'Debabrata', 'Alaka' & 'Nanda' on the 8th January, 1980 creating history. With this, Nandankanan created its own family of white tigers and a separate gene pool of tigers. The park forged ahead in its developmental activities under the advise & guidance of Nandankanan Development Board to become a leading zoo in the country with a wide variety of animals in near natural environment. On 20th Jan 1984, a Lion safari over 20 ha. was inaugurated inside the zoo premises. There after the first White Tiger safari spread over 12 ha was also established in the year 1991.

During these 49 years of existence, the zoo has bred number of species of animals and birds. Many of them are endangered as per the Wildlife (Protection) Act, 1972. Some of them are tigers (normal colored and white), leopards (black & normal), Asiatic lion, all the three species Indian crocodilian, liontailed macaque, Nilgiri langur, peafowl, Indian pangolin, thamin deer, and many others.

A toy train has been in operation in the park since 10th August'1971 donated by the Ministry of railways, Government of India. A rope way also links zoological park with the botanical garden since 01.10.1994. This has been constructed and is being operated by a private company without any financial involvement of the zoo.

The park grew in its size and content with addition of species and several new facilities till October, 1999 when a devastating cyclone of unprecedented fury struck the zoo. Within two days the cyclone ruined the park damaging all the facilities, uprooting the trees, & resulting in

death and escape of many animals and bird species. The zoo faced another calamity of different kind on 4-7th July'2000 when 11 tigers both normal and white succumbed to a blood borne disease called "Trypanosomiasis". By then, the zoo had not completely recovered from the cyclone effect, which had struck 8 months back. This shocked the international community and conservation minded individuals/organizations of the country. A High Power Committee was set by the Central Zoo Authority, Government of India to suggest : (a) ways and means to prevent further death of animals, and (b) improve the health and hygiene of the zoo animals and (c)to prevent casualty to the animals by disease.

The park along with the adjoining forests and Kanjia lake has been notified as Nandankanan Wildlife Sanctuary vide erstwhile Forest, Fisheries & Animal Husbandry Department, Government of Orissa Notification No. 8F(WL)-160/78-20672/FFAH dated 3rd August 1979 and published in the Official Gazette vide S R O No.935/79 dated 3rd August 1979. The Survey of India (SOI) has published a tourist map of the Nandankanan in 1981 detailing sanctuary and park in 1:7500 scale topography sheet. In the mean time the boundary of Nandankanan sanctuary has been dileaneted in the ground & map has been prepared.

1.3.1 Uniqueness of Nandankanan Zoological Park

a. Host zoo for white tigers. White tigers born to normal coloured parents in 1980.
b. First captive breeding centre for endangered Gharials (1980).
c. A unique White tiger safari established on 1st October 1991
d. Wonderful site for wildlife conservation and education – integration of *ex-situ* and *in-situ* conservation (free living birds - 65 spp.; reptiles – 15 spp. mammals – 13, butterflies – 85 spp., fish – 46 spp. & prawn – 3 spp.).
e. Kanjia Lake – A wetland of National importance (2006).
f. Conservation Breeding Centres for Indian Pangolin and White backed vultures.
g. Largest pools for housing Gharials and Hippopotamous.
h. Second largest heronry for open billed storks (approx.12,000 nos.) in Orissa.
i. Situated inside a natural forest of semi-ever green and moist deciduous nature (424 spp. of plants)
j. Captive Fodder farm (over 30 Acs.)& Slaughter house
k. First zoo in the country to become member of World Association of Zoos & Aquarium.

1.4 Objectives

The objectives mentioned in the master plan for 2001-2020 approved by the State Govt.are furnished below

(i) Conservation, breeding of different species particularly those endangered species belonging to the region for preservation of biodiversity, exchange with other zoological parks and rehabilitation of suitable endangered species in the wild with strict adherence to the guidelines framed for the purpose.

(ii) Research and scientific study on animal behaviour, diseases and their control, feed and nutrition and reproductive biology. The knowledge so gained can be made use of in management of wildlife in the wild.

(iii) Promote nature education and interpretation for communicating the same to the visiting public in general and younger generation in particular for appreciating the need of wildlife conservation.

(iv) To develop it as a training centre for management of wild animals and their upkeep, besides training on zoo design and planning to the staff of the zoo and of the region, Veterinarians and others take advantage of the knowledge and experience gathered in captive management of wildlife here.

(v) Providing healthy wholesome recreation through wildlife education to the visiting public utilizing ambience of the setting of the Zoological Park, keeping in view, the safety and upkeep of zoo animals. Recreation shall only be incidental and shall not be the main objective at any time.

1.5 Physical features

1.5.1 Topography of the area

The land is characterized by undulating topography, broken by low hills of very gentle slope. The Botanical garden is having steeper hills in comparison to Zoological Park. The hills run from east to west direction having slopes facing north and south direction. These remnant hills forms part of erstwhile Khurda mals.

The lowest point is 20m from MSL in Katurighasa pata near Hamiratangi area of Zoological Park. Similarly the highest point is 45m from MSL in Ropeway station area.

1.5.2 Biogeographic region

According to Rodger's & Panwar (1988), Biogeographic classification of India, Nandankanan zoo confirms to the following region–

Biogeographic zone- 06 Deccan Peninsula

Biogeographic province- 06 C Eastern Highlands

Subdivision- The Eastern Ghats

Nandankanan zoo is of great ecological interest as it is the wettest part of the Deccan zone. It has the elements of moist forests of the eastern ghats in south-east Orissa having communities of considerable biodiversity interest. The forest of Nandankanan zoo includes many semi-evergreen elements which are important biogeographic stepping stones in the link between the forest species of north-east and south-west India. The existing wildlife in Nandankanan zoo is classified under the Indian Peninsular sub-regions which forms part of the Oriental Zoo-Geographical Realm of the World.

1.5.3 Geology, rock and soil

The stratigraphy is as follows:

Sl. No.	Litho unit	Age
1.	Lateritic soil	Pleistocene (2 million years)
2.	Laterite	Cenozoic (7 million years)

The strike of the rock units in general, tends NE and SW with gentle dip towards south east.

The Zoological Park is predominantly having laterite capping, while the Botanical Garden is having both sand-silt-clay deposit as well as lateritic soil.

Soil depth varies from place to place. Sub soil moisture is sufficient to promote good forest cover as laterites have excellent water holding capacity. Soil humus is practically absent in the hilltops having laterite soil in Nandankanan Zoological Park.

1.5.4 Flora & Fauna

The details of flora & fauna given in **Annexure-IV & V.**

The **Orchidarium** was set up during 2006. It was further expanded during 2007. More than 100 potted and hanging type orchids are available which includes both wild as well as hybrid collections.

1.5.5 Climate

There are three distinct seasons experienced in the sanctuary area. The monsoon normally commence from mid June and lasts till mid October. Winter season starts from November and lasts until middle of February when summer starts. Hot and humid weather follows till the onset of monsoon. The dry spell is occasionally interrupted by the thunder storms and cyclonic spells.

1.5.6 Rainfall

The bulk of precipitation occurs during the rainy season by south-west monsoon. Usually the monsoon sets from second week of June and continues up to mid October. Pre-monsoon showers are also experienced during May and 1st week of June. Thunder storm occurs during April & May. The average number of rainy days in a year is 100 days out of which 70 are confined between June to September. The annual average rainfall varies between 1220mm to 1902mm.

High floods are not common in Nandankanan zoo area. However flood occurs during 1999 super cyclone and July'2001 when flood water inundated low lying areas of the park including fodder farm. The severity of the flood during last week of August 1982 was disastrous.

Rainfall data

Year	Annual rainfall in mm	No. of rainy days
2006	1727.1	94
2007	1590.1	98
2008	1744.9	107

Source- OUAT, Meteorological station, Bhubaneswar.

1.5.7 Humidity- The mean annual maximum humidity varies from 90% to 93% and the mean annual minimum humidity varies from 55% to 61%. The maximum humidity occurs during rainy season. The dewfall is normally experienced during February and March. Fog is experienced during winter.

Relative humidity data

Year	RH % (Forenoon)	RH% (Afternoon)	RH% average
2006	91.2	55.7	73.45
2007	91	57.0	74.0
2008	92.41	58.91	75.66

Source- OUAT, Meteorological station, Bhubaneswar.

1.5.8 Wind speed

No proper data is available. However during April, May thunder storm is experienced with wind velocity exceeding 60 Km./hr.

1.5.9 Drought and its periodicity

Both atmospheric drought and extreme dry soil drought is experienced due to erratic monsoon as a result of ELnino and LAnina effect. The intensity, duration and amount of rainfall together with distribution pattern lead to drought and flood. The economy of rural people in and around PA depends upon nature and periodicity of drought. Drought is the single most deterrent factor in determining the condition of forest. During the drought years, the locals form the adjoining villages resort to illicit removal of the forest growth for sustenance. Drought affects the general vegetation by way of failure of regeneration.

1.5.10 Temperature

The advent of summer is felt from end of February to first week of March when temperature starts rising. Summer months are very hot and dry. Maximum day temperature varies from 35^0 C to 41^0 C in the month of May which rarely crosses 45^0 C. With onset of monsoon, the temperature drops considerably. From mid October, the nights become cooler and gradually both day and night temperature falls appreciably. December and January are the coolest months where the night temperature drops to 7^0 to 9^0 C.

Temperature data

Year	Mean maximum temperature	Mean minimum temperature
2006	33.1	22.8
2007	32.8	22.3
2008	32.5	22.2

Source- OUAT, Meteorological station, Bhubaneswar.

1.5.11 Season

There are three distinct seasons experienced in Nandankanan Zoological Park. These are summer season from February to June, rainy season from July to September and winter season from October to January.

1.5.12 Approach

The park is situated between $20^0$23'8" to $20^0$24'10" North latitude and $85^0$48'9" to $85^0$48'13" East longitude. The zoo is located at a distance of 17 kms from Cuttack and 20 kms from Bhubaneswar the State capital by road. The nearest railway station is Barang (East Coast Railway) which is less than 1 km. away from zoo boundary. The Director, Nandankanan

Zoological Park is in overall charge of Nandankanan zoo with headquarter at Mayur Bhawan, Saheednagar, Bhubaneswar. The Bhubaneswar Railway station is 18 km. and Cuttack Railway station is about 15 kms from the zoo. The nearest Airport is Bhubaneswar which is about 20 kms. away.

1.5.13 Demography of surrounding area

The details of adjoining villages with respect to families and population are given below.

Name of the village	Total population	Total family	Total livestock
Daruthenga	2869	577	984
Krushnanagar	399	92	168
Jujhagarh	2244	44	314
Raghunathpur	2925	488	985
Padasahi	2349	455	367
Barang (Dadha)	4417	900	65
Total	**15203**	**2556**	**2883**

1.6 Legal status of the land

The entire Nandankanan Zoological Park comprises a portion of Krushnanagar and Jujhagarh demarcated protected forests and Kanjia lake which are Government land and the entire area forms a part of Nandankanan sanctuary.

The zoological park along with the adjoining forests has been notified as Nandankanan Wildlife Sanctuary vide erstwhile Forest, Fisheries & Animal Husbandry Department, Government of Orissa Notification No. 8F (WL)-160/78-20672/FFAH dated 3rd August 1979 and published in the official gezzette vide S.R.O. No. 935/79 dated 3rd August 1979. The sanctuary has been declared u/s 18 of Wildlife (Protection) Act, 1972 amended. The final notification u/s 26 Wildlife (Protection) Act, 1972 is yet to be done. The Survey of India has published a tourist map of the Nandankanan in 1981 detailing sanctuary and park (in 1: 7500 scale). The area computation for different purposes in January 2001 by the Survey of India, Bhubaneswar for sanctuary, park, botanical garden and lake within it shows the following extent:

Nandankanan sanctuary area		437.1 ha.
Kanjia Lake	66.1 ha.	
Botanical garden	75 ha.	
Zoological Park (without Kanjia lake)	296 ha.	

Notification of D.P.F. within Nandankanan Zoological Park

Krushnanagar D.P.F.	(1) Bengal Gazette dt. 11.08.1880 (vide para-1 page 698) (2) Notified in Govt. of Orissa Development Deptt. No. 36169/D-12F-220/56 BBSR, the 30th November, 1957
Jujhagarh D.P.F.	Bengal Gazette dt. 11.08.1880 (vide para-1 page 698)

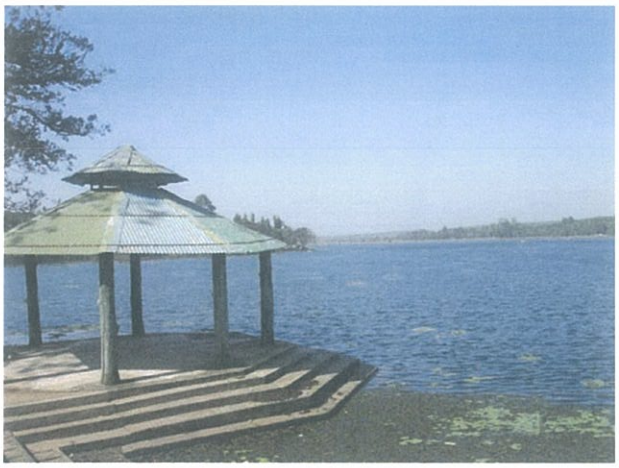
The perimeter of NKZP is 8.65 km.

1.7 Sources of pollution

NKZP is situated in a natural vegetation area and the pollution load is very negligent. The glass factory which was situated close to the NKZP is now closed and there are no industry or major township in the adjoining area.

1.8 Kanjia lake eco-system

Kanjia lake popularly known as Nandankanan lake is situated between 85° 48' to 85° 50' East longitudes and between 20° 23' to 20° 25' North latitudes. It is an important wetland lying to the south of Mahanadi delta head, within the boundary of Nandankanan Zoological Park. The zoological park remains in the south side of the lake where as the Botanical garden is situated in the north side of the lake. At the same time, it has got immense socioeconomic value as the fishermen from the local village derive their livelihood. The wetland is facing management problems like siltation, eutrophication, weed infestation, proliferation of invasive species and shoreline shrinkage. Kanjia lake has been declared as a "Wetland of National Importance" by MoEF, Govt. of India since 2006.



1.9 Present ground situation

Although there is laterite compound wall along western side, southern side and most part of eastern side, the Katurighasa pata (wetland) area need to be protected by construction of boundary wall. The existing staff colonies inside the park need to be relocated outside the park. The thoroughfare connecting Raghunathpur and Darutheng village passing through NKZP needs

to be closed by giving an alternate route. The building activities on the eastern side and western side of the park are possing a serious threat for the future management of the park.

1.10 Layout:

Although the zoo has animal collection from different regions of the country and from other continents of the world, it is proposed to adopt broad taxonomic display for convenience of management, research and education. The broad classification would be as follows-

a) Large carnivores like tigers, leopards, jaguars, lions, bears etc.
b) Large mammalians elephants, hippopotamus, rhinoceros etc.
c) Small carnivores
d) Other small mammals like rodents, marsupials etc.
e) Nocturnal animals.
f) Ungulates
g) Primates
h) Reptiles including crocodilians
i) Water birds.
j) Terrestrial birds including birds of prey
k) Flightless birds
l) Aviary birds (small birds)
m) Fishes
n) Amphibians
o) Invertebrates.

As far as possible, the above classification will be followed except specialized enclosures for nocturnal animals or small mammals etc. which shall be maintained in order to provide adequate care to these specialized group of animals.

1.11 Description of different facilities

The sylvan setup of the park boasts for many special features, which lure the visitors. Following visitor facilities are available inside NKZP.

Boating

Boating in Kanjia lake on paddle or row boats in the aquamarine blue water is an exhilarating experience. The multi slorey Boat Ghat is renovated to give new look with enough space for the visitors to relax and enjoy the picturesque lake. The boating service is outsourced for better management

and satisfaction of the visitors. The lake is also known for its rich floral and faunal diversity. Signages highlighting the importance of wetland are affixed near the boat ghat to create awareness for conservation and wise-use of wetlands.

White tiger and lion safari

A twenty minute drive through the meandering roads in a specially protected vehicle, takes the visitors straight into prides of lions and right in front of the most fascinating white tigers. It exposess the visitors to unique reverse situation where the visitors are confined in a vehicle and the animals are in open around them. NKZP is the only zoo in India with a white tiger safari.

Besides the carnivores, the visitors will also experience a tour inside the natural surroundings which also supports spotted deer, peafowl and many other species of flora and fauna.

Nocturnal animal house

Many animals that only move freely at night but are almost immobile and hide in the thicket or in their burrow during the day are housed here. The twilight condition is created in these enclosures to stimulate these animals to become active which provide an opportunity to the visitors to know what these animals secretively do in the dark of the night.

Aerial Ropeway

This 620 meter long ropeway transports the visitors across the lake to the Botanical Garden on the other side, which has many varieties of plants including rare and endangered species of flora. A number of gardens, cactus house,

orchidarium, rose garden, Kiakani lake etc. are few attractions for the visitors.

Reptile Park

A reptile park, with a life size Tyrannosaurus at its entrance with a cave-like interpretation centre houses 20 species of reptiles including crocodile, lizards, turtles and snakes. One would encounter king cobra, pythons, star tortoise, six species of crocodiles, water monitor lizard, chameleon etc. inside reptile park.

Toy Train

The Toy Train has been a great attraction for the kids. It starts from the baby toy train station which goes round a circular tract of 1.58 km. along the lake and thickly vegetated area with free ranging herbivores. During the train ride, the visitors experience many important facts of environmental education especially or plant biodiversity and wetland conservation.

Aquarium

Aquarium is on integral competent of a modern zoo. A modern aquarium is commissioned during February, 2008 inside the premises of NKZP. Adequate steps were taken to include the well researched aducation materials on the various aquatic ecosystems. The local fish species of Kanjia lake are their uniqueness and their conservation also displayed in the aquarium.

Library

The centrally located library, with a wonderful collection of books and periodicals on wildlife is an important treasure of NKZP. The library has been maintained since last 50 years and rare books on wildlife are available here.

3-D Theatre

One 3-D theatre is running near the ticket checking gate where wildlife films are being shown to visitors especially to school children for creating awareness for protection conservation of our wildlife and natural heritage.

Children's Park

Various playing facilities for children are being provided in the children's park.

Other visitor facilities- It includes drinking water Kiosks, toilets, wheel chairs and ramps for physically challenged persons, parking place, Food Court, Restaurant run by Orissa Tourism Development Corporation, cloak room, sit-outs, Nature shop, small museum, guide map, directional and interpretive signages, publications etc. Interactive educational awareness programmes, conducted tour for school children and trained registered guides are also available.

1.12 Difficulties faced in the management in the past and achievements

Entry of visitors and vehicles through the western gate has been stopped. This has reduced the disturbance and strengthen the security system of the park. Earlier parking was allowed inside the parkwhich was stopped since 2006 and new parking area has been developed and outsourced for better management. Elephant ride has been discontinued since long to avoid mishaps. Picnic has been discontinued to prevent law & order situation. The private shops and eateries have been removed from the park. Boating, toy train and safaris have been outsourced to reduce management problem. In order to strengthen surveillance system, CCTV cameras have

been fixed in booking counters, gate complex and gate No.II. In order to provide safe drinking water to visitors, chlorination plant and aquaguards have been provided. In order to ensure regular supply of fresh and hygienically processed buffalo meat for the carnivores, one captive slaughter house was set up during 2007 which is first of its kind in Indian zoos. The captive fodder farm has also been set up which ensures constant quality supply of feed to the herbivores housed in NKZP.

PART-I

CHAPTER-II

APPRAISAL OF THE PRESENT ARRANGEMENT & CONSTRAINTS

2. Area of the Zoo under different uses

The Zoological Park covers an area of 362.1 ha. including the water body of Kanjia lake (66.1) ha. The present coverage of the area for different purposes are as follows:

Sl. No.	Description	Area in ha.	Area in sqkm.
1.	**Animal enclosures/safaris**		
a.	Area of animal enclosures (101)	102457.5	10.25
b.	Moated elephant enclosure	15817.4	1.58
c.	White Tiger safari	132923.5	13.29
d.	Bear safari (proposed)	76996.95	7.70
e.	Lion safari	209796.59	20.98
f.	Feeding cubicle (lion safari)	920.25	0.09
g.	Herbivore safari (proposed)	348277.12	34.83
h.	Nocturnal house	406.26	0.04
i.	Reptile Park	5155.82	0.52
j.	Water bird aviary	2251.44	0.23
k.	Aquarium	331.61	0.03
2.	**Administrative facility**		
a.	Security Range Office	121.46	0.01
b.	Office of Deputy Director and Assistant Director	313.53	0.03
3.	**Residential Quarter**		
a.	Colony near Gate No.I	41917.6	4.19
b.	Colony near cattle bridge	2583.27	0.26
c.	Colony near Gate (South)	5754.46	0.58
d.	Colony near Gate (North)	1000.00	0.10
4.	**Zoo Hospital**		
(a)	Zoo Hospital	759.36	0.08

(b)	Quarantine	960.36	0.10
5.	**New Gate Complex**	697.932	0.07
6.	**Other facilities**		
a.	Parking Area	16523.74	1.65
b.	Restaurant/Canteen	728.11	0.07
c.	Guest House/Cottage	5678.93	0.67
d.	Lawn	62536.12	6.25
e.	Children Park	2103.58	0.21
f.	3D Theatre	214.35	0.02
g.	Ropeway station	396.00	0.04
h.	(a) Toy train station	358.63	0.04
	(b) Railway track	9444.3	9.44
i.	Boat Ghat	97.43	0.01
j.	Roads	24693.6	24.69

The zoo has completed 49 years of its existence. Over the years, several structural improvements have taken place inside the zoo. The improvements have been taken up in a phased manner. As special features of the zoo, a Lion safari (20 ha) and White Tiger Safari (12 ha), Reptile park, Nocturnal animal house, Aquarium, Toy train and rope way joining the botanical garden across the lake over a length of 620 m have been created. There are 24 tiger enclosures in addition to enclosures for other large cats like lions, leopard, etc. There are specific enclosures for bear, hyena, aviary for small birds, birds of prey, flightless birds, water birds etc. There are also enclosures for many species of ungulates.

2.(a) (i) <u>Animal Section</u>:

Originally, the enclosures were clustered together for carnivores, herbivores, birds and reptiles. Though, there has been some mixing in the process of development, more or less they continue to be distributed separately without being specific for geographical distribution of animals. This has also helped to manage the animal better and more conveniently. Sometimes, deviations have taken place as whenever an enclosure meant for certain species has fallen vacant. The vacated enclosure has been allotted to some other species who could be conveniently housed

in the said exhibit, without much modification. Captive animals have been housed species wise for better management.

Diversity

At present, there are 101 enclosures (with sub enclosures, quarantine totaling 202) with 54 cages and 47 moated enclosures. The total number of captive animals as on 30.09.2009 is given below

	Species	No.
Mammal	40	589
Birds	54	749
Reptiles	24	117
	118	1455

Supervision

The enclosures are under supervision of following staff.

Range Officer, Animal/Sanctuary management -	1
Forester - - -	3
Forest Guards - - -	5
Animal Keepers - -	20
Mahunt - - -	2
Mate (For elephant) - -	2
Sweeper - - -	5
Zoo Watcher - - -	1
EPF workers- - -	51

Innovations in the Zoo

(a) The first successful captive breeding programme in the world for endangered gharials (*Gavialis gangeticus*) was started in Nandankanan Zoological Park in 1980. This was possible by getting one male gharial "Bajrabahu" from Frank Furt Zoo for breeding. More than 700 gharials have been released in the wild after rearing in Nandankanan.

(b) The first white tigers were born in 1980 from normal coloured parents. Many white tigers have been sent to various zoos within the country and abroad on exchange basis. The first white tiger safari in the world was started in 1991 in Nandankanan.

(c) The first successful captive breeding of Indian pangolin (*Manis crassicaudata*) in Nandankanan Zoological Park was on 17.11.1971. So far 16 pangolins have been bred in the zoo.

Renovations in the Zoo

- Some of the enclosures, cages and animal houses which have been built in the past do not serve the purpose of modern zoo management and some of them have either become very old, dilapidated or have been damaged during the cyclone. Some of them have also been suggested for demolition or reconstruction by the Evaluation Committee of Central Zoo Authority. As per the Evaluation Committee suggestion following enclosures demolished and reconstructed.

1. Brahmin Kite
2. Vulture
3. Tiger
4. Mouse Deer
5. Primate enclosures
6. Water bird aviary

- Following enclosures have been renovated under Modern Zoo Management since they were old structures.

1. Leopard enclosure
2. Nicober pigeon

The enclosures for the monkeys, birds and some other species do not adequately meet the biological needs of the concerned animals as well as to their security. There is a need to reconstruct them or to go for completely new enclosures. Some of them do not provide adequate protection against varying weather conditions. Following enclosures of the Monkeys, Birds and some species have been reconstructed/renovated to meet the biological needs of the concerned animals.

Three of the very old enclosures for the leopards and tigers have been recommended for demolition and reconstruction of new enclosures in modern line have been recommended.

It has also been suggested to provide individual night shelters for all carnivores and also to make them slightly elevated to prevent dampness. It has also been suggested to provide fixed

type squeeze cage with each cluster of night shelters of an animal house. Accordingly Night shelters have been provided to all carnivores along with squeeze cages.

Portion of the white tiger safari & Lion Safari chain link mesh fence have been repaired during last 5 years wherever it is highly damaged to prevent escape of animal. Still large portion of the chain link mesh fence is in need of repair by replacing new chain link mesh. During 2005-2006, 450 rm. Laterite secondary wall constructed as second line of defence to White tiger safari & 100 rm. of laterite Secondary wall to Lion Safari. About 1080 m of white tiger safari and 1785 m of lion safari secondary wall are still to be covered to complete the work.

New water bird aviary has been constructed on the location where old damage water Bird enclosure existing which was damaged during recent cyclone. The new water bird aviary is approximately 2250 Sq m. There is enough space to water birds to fly and glide. The natural water body & trees have been retained for nesting inside the enclosure. The floorings of most of the enclosures which were in bad shape have been repaired.

Three primate enclosures have been renovated during 2002-2003 providing six feeding cubicles, a keepers way. The damaged roof has also been repaired. At present six are housed in the enclosure. Another primate enclosure which is half constructed is completed with moat wall and two feeding cubicles and at present Orangutan is housed in the enclosure. Stand off barrier has been provided keeping in view of the safety & security of the animal.

Enrichment have been provided in enclosures housing Bear, Chimpanzee, lion tailed macaque, nilgir langur, hamadryas baboon, orangutan enclosures and newly constructed Tiger enclosure No.20.

The domestic stock available viz. mithun, guinea pig in the zoo is kept off exhibit as per the guidelines of Central Zoo Authority. The roof structure in Reptile Park enclosures which was damaged has been repaired. One new moated elephant enclosure over an area of 5 ac. area has been inaugurated during February, 2008 where four elephants have been housed.

There is shortage of residential quarters for housing of Officers and other field staff. Hence, the residential quarters for the Assistant Director, Range Officers, field staff and also for the animal keepers deployed in animal section and security section need to be constructed. Residential accommodation for the Veterinary Doctors is essential for meeting any emergency health situations during the night hours.

Since there is no mini truck available, a new Mini truck is to be purchased which is highly essential for transportation of feed. One new City Ride bus has already been procured for safari inspection purpose. The 3 nos. of Battery Operated Vehicles which are lying idle, require annual maintenance for smooth running. One Diesel Mobile van has been purchased during 2004-2005 which is being used for various purposes. One tractor purchased during 2008 is being engaged in fodder farm and transportation of other materials.

Aquarium

One new aquarium has been inaugurated on 04.02.2008. This was established with the help of Centre for Environmental Education, Ahmedabad and Mastyam, Ahmedabad. This is a modern aquarium with hi-tech equipments. There are 14 aquaria including two marine reef aquaria. Many varieties of fishes and marine fauna have been accommodated including fishes from Kanjia lake. The species include Gold fish, Gourami, Piranah, Angel, Star fish etc.

Single sexed animals:

The list of single sexed animals have been given in **Annexure- XI** There are many species of birds, mammals and reptiles which are either one specimen or more specimen of the same sex. It is mandatory to obtain a mate to the single animals either by procurement or by exchange for pairing.

Acquiring of animals:

At present many bird enclosures, Asiatic Wild Ass, Giraffe, old leopard enclosure etc. are lying vacant. Giraffe, Gibbon, Kangaroo, green iguana are in great demand as per visitors and guides feed back. Giraffe is a very attractive animal for which the new enclosure has already been constructed. In order to increase the species diversity and to provide partners to the single sexed animals, some animals are to be acquired urgently.

Dewatering of the moats:

It is always very difficult to maintain the quality of moat water in the zoos. There is public criticism as the moat water turns green due to profuse algal bloom. Wet moats are being maintained for tigers, bears and primates. During monsoon, some dry moats are converted into wet moat category for a brief period. Salvinia weed growth, water hyacinth, paragrass growth is

found in wet moats of deer and antelope enclosure facing the Kanjia lake. Wet moats are difficult to maintain on the basis of quality of water. Therefore, it is desired to pump out the dirty water from the wet moats at frequent intervals which are some times very expensive and cumbersome. Desilting is also needed for maintaining wet moats from time to time.

Identification of animals:

Individual animals in the zoo need to be identified for effective management, maintaining medical history, continuity of animal history etc. Most of the tigers, lions, elephants, pangolins, etc. have been microchipped. Leg bands are being used for vultures, Bhutan pheasant and nicobar pigeon. Microchipping of water monitor lizards, king cobra, mouse deer, rhino, nilgiri langur and two sloth bears have been completed so far.

Rajbhawan Deer Park

In order to have a wilderness area, one deer park in Rajbhawan was inaugurated on 2nd October, 1973 by Sri B.D. Jatti, the then Governor of Orissa. Only one male and one female spotted deer were released along with one male and two female blackbucks. The area of the deer park within the Rajbhawan premises was extended on 14th November, 1989 by Prof. S. Nurul Hassain, the then Governor of Orissa. The area of the second deer park was 4 ha. The present population in the deer park is 179 (105 stags, 74 does) spotted deer and 6 blackbucks (4 bucks, 2 does). At present the animals are fed deer mash in the forenoon and fodder and grass in the afternoon. Excess deer and blackbuck population were translocated from Rajbhawan Deer Park to other places in a phased manner from 1984-85 till date. The Rajbhawan deer park is a satellite facility of Nandankanan Zoological Park for accommodating spotted deer & black buck.

2(a) (ii) Veterinary Section:

Veterinary Hospital

Nandankanan Zoological Park has a well equipped veterinary hospital with facilities viz. Operation Theatre, X-ray unit, Laminar flow, photograph development unit, laboratory, ultramodern microscope with photographic attachment, tranquilizing equipments. There is an isolation unit and quarantine unit. The diagnostic laboratory has all basic equipments viz. incubators, deep freeze, autoclave, centrifuse machines, laboratory chemicals etc. However there

is furhter need to renovate the isolation unit with other facilities viz. physiotherapy unit, treatment accommodating reptiles, birds, mammals (carnivore and herbivore) separately. There is need for one in built large squeeze cage for better treatment of problematic animals. The existing old zoo hospital need to be demolished and one new modern zoo hospital need to be constructed for proper functioning of the veterinary activities. Digital camera, VHF hand sets, Binoculars etc. have been provided to zoo hospital. One jeep and one motor cycle have been provided for use by zoo vets for their routine inspection of zoo animals and their treatment.

The hospital is being managed by the Senior Veterinary Officer who is supported by two Veterinary Assistant Surgeons and three Livestock Inspectors.

Functioning of Veterinary staff

The zoo has complete range of tranquilizing equipments to facilitate treatment of animals. There is a routine protocol for vaccination, deworming etc. which are being followed by the zoo vets. All the sick animals are being treated immediately. Whenever required the help of Technical Committee is being taken to solve the problem related to animal health care. The Centre for Wildlife Health, Orissa Veterinary College, Bhubaneswar is being involved in treatment of sick animals. Vaccination have been carried out in peripheral villages for Foot and Mouth Disease, Hemorrhagic septicemia etc. with the help of State Veterinary & Animal Husbandry Department to reduce the chance of epidemics.

Quarantine:

The quarantine has cubicles without kraals for which housing large carnivore is not possible. The existing quarantine unit needs to be strengthened by replacing iron chainlinkmesh with square bars to avoid escape of rescued bears and to reduce injury due to old chainlinkmesh. One large overhead water storage tank need to be constructed as the existing small storage tank has less capacity. Shade bearing plants to be planted on south-western side of quarantine unit outside. The ventilation and flooring need to be augmented. The quarantine need to be upgraded by creating facility for housing rescued birds and reptiles. Further colouring of iron structure and white washing of cubicles need to be done from time to time. For proper ventilation each cubicle is proposed to be provided with windows for free access of air from south.

2 (a) (iii) Store & feed supply section

Altogether 82 feed items are being procured through various agencies. Out of these 27 items are being procured from Tribal Development Cooperative Corporation (T.D.C.C.), Bhubaneswar, one item is being procured from Orissa Milk Federation (OMFED), 15 items

supplied departmentally and 39 items are being supplied through approved feed contractors. Perishable and non-perishable food items are being stored separately. Every day feed items are being checked by superving officers and zoo veterinarians.

One feed distribution centre is being maintained where the non-perishable feed materials are being stored. The feed mixing is also done here. The feed distribution centre has flooring with glazed tiles, fly proof netting and electric fly catchers. Electric weighing machine has been provided inside the feed receiving centre with facility for deep freezing for perishable items.

Feed Stores: There is urgent need for construction of a separate dry feed store for storing hoads of dry feed procured from various sources. At present 82 varieties of feed is being procured besides other seasonal fruits and vegetables. There is a deep freezer for storing fish and meat in case of emergency. Ante-mortem and post mortem is being done hermetically by zoo vets for which the quality of buffalo meat is being ensured. Provision of electricity and water supply has already been ensured. One wood based incinerator and overhead water storage tank have been constructed.

Zoo Kitchen: The zoo kitchen has been renovated and provided with 4 gas cylinders and store. Other cooking utensils are available. Cooked food for bear, monkeys are prepared including rice, dal, boiled egg, amul milk etc. Overnight soaked wheat for elephants, soaked bengal gram for birds, monkeys are being carried out here.

Veterinary check: The zoo vets conduct regular inspection of feed receiving centre to eliminate any defective food item viz. perishable items viz. vegetables and fruits, fish, goat meat, chicken etc. Further they check the quality of beef in slaughter house. They ensure cleanliness of slaughter house and feed receiving centre. Special feed prescription is being done for lactating mothers, nursing young ones. Both the veterinarians and Range Officer, Animal Management section check the quality of non-perishable items.

In the present system, respective animal keeper used to collect and carry feed items to animal enclosure. In some cases, dry feed items are also being provided by some animal section

staff deployed for the purpose by food trolley. However there is urgent need for procuring one feed transportation vehicle for the purpose. The contractor for buffalo meat is delivering the same near the gates in respective carnivore enclosures.

Fodder cultivation:

A fodder farm extending over an area of 33 Ac has been established since 1992 on the western part of the zoo with irrigation facility. Roughly 20 quintals of green fodder viz. para grass, NB21, common grasses etc. are supplied to the zoo herbivores every day. Both cereal and legume fodder along with bamboo and banana culms are being harvested in small quantities depending upon the season. In order to meet the shortage of fodder during winter months oat and berseem are being cultivated. Legume fodders viz. lucerne, cowpea, ricebean and cereal fodders viz. fodder maize, sorghum, humidicola are being cultivated. Cultivation of banana are also being carried out to supplement elephant feed during summer.

Although self-sufficiency has been achieved in producing cereal and legume fodder in fodder farm, yet tree fodders are being procured from tree fodder contractors. Planting of bamboos and Ficus plants have taken up recently both inside fodder farm as well as other areas of the zoo. However it would take a few years till we will be able to harvest tree fodder by lopping. The tree fodder contractors are also facing difficulty in procuring *Ficus bengalensis* and *Ficus religiosa* tree fodder from in and around Bhubaneswar. It is also contemplated to take up plantation of other tree fodder species viz. subabul (*Leucaena leucocephata*) and other species recommended by Fodder Specialist of Orissa University of Agriculture and Technology.

2 (a) (iv) Sanitation section:

Sanitation is looked after by the animal section as a part of its routine activity. This section takes care of the general cleanliness of the animal enclosures. The tractor which is available in the park is often used to carry garbage collected in different dust bins located at vantage points of the park and pass bio-degradable materials to the compost pits while the rest is disposed off outside the park. They also clean animal moats and water ponds inside the

enclosures. Sanitation of the Park has already been outsourced for better management due to shortage of existing man power.

2 (a) (v) Maintenance section

Workshop is very important for a large zoo like NKZP and without which day to day maintenance of all enclosures, structures, buildings, water supply, electricity would not be possible to attend immediate crisis. The safety and security of animal is paramount and whenever there is a problem, this has to be attended without any loss of time. The work shop in the park is being maintained Animal & Sanctuary Management section. To keep the present workshop in proper shape, it is necessary that a new workshop building may be constructed in the same area in an elevated position as the present workshop is running in a dilapidated kutcha house.

Since the existing staff are quite inadequate for proper maintenance, it is proposed to outsource through Annual Maintenance Contract (AMC). However the materials would be supplied by the zoo management.

2 (a) (vi) Security Section:

Since the zoo has extended over a very large area and a portion of which on the north of the lake is occupied by botanical garden, that side of the park has not been well fenced. Laterite stone boundary wall has been completed on western and southern side. The same is in progress on the eastern side. After demarcation of park boundary during 2008, permanent boundary pillar posting has been completed. Due to porous nature of park boundary particularly on the eastern side, construction of boundary wall need to be completed. However during the last three years incidence of cattle trespassing has been curtailed. The existing laterite stone boundary wall around the zoo is not sufficient to prevent entry of unscrupulous persons. Therefore there is need for construction of strong laterite stone boundary wall upto 10 ft. high fortified with "Y" type barbed wire fencing.

The staffing pattern:

The security section is managed by one Range Officer, two Foresters, three Forst Guards one Zoo Watcher, one Zoo Watchman and twenty six labourers (EPF registered). One jeep is

being provided for regular night patrolling inside the park during night time. A dedicated vehicle with VHF system is highly essential for the purpose.

Security threats

A thoroughfare running through the heart of the park creates measure security threats for the zoo animals. Alternative route need to be provided to these villagers to prevent thoroughfare inside the zoo premises. Keeping in view of safety and security of captive animals, the staff colonies need to be relocated outside the park in a phased manner. The security staff function round the clock in the park in three shifts. In addition to security staff, Range Officers and other staff have been assigned night patrolling duty on rotation basis.

2 (a) (vii) Water supply & electricity section

Large quantity of water is required for maintenance of wet moats, animal house cleaning, staff quarters, watering the lawns & gardens, drinking purposes and toilets. At present the water supply is being done from various sources within the park. These sources have been developed with the expanding infrastructure of the park over the years. There are two deep bore wells, two dug wells and two water reservoirs which meet most of the animals water requirement. Water is also drawn from the Kanjia lake for water supply for different purposes by 40 HP monoblock pump sets and a 15 HP submersible pump for drinking purpose. There is a need for further up-gradation of water supply to provide safe drinking water to animals, staff and their families and visitors preferably from deep bore wells. **Online Chlorination** of water supply system has already been started since 2007. All the animal enclosures have been provided with potable water round the clock. Separate pipe lines have been laid to Gharial pool, Mugger pool and Aquarium to prevent supply of chlorinated water. It is contemplated to have a few overhead tanks and sumps for storing adequate water to ensure sustain water supply to animal enclosures, visitors and staff colonies. Although sufficient water is available in Kanjia lake yet it is proposed to have at least two deep tube wells to provide quality ground water after proper ground water survey.

The park receives power from 11 KV line through two 100 KVA transformers set up inside the park. However, NKZP is located in a rural zone, there is difficulty in ensuring uninterrupted power supply to the park. Some times power supply to the park remains cut off for days together, creating problem for the water supply. As a back up support, one 200 KV. Diesel generator (DG) set has been installed inside the park. This can be made operational with necessary cable connection etc. so that in the event of non-supply of power, the DG set can meet the emergent power needs. In order to get uninterrupted power supply installation of 33 KV line is in the completion stage. Two new 250 KVA transformers have already been installed to meet the future power demand of the park.

The existing drainage system is not adequate and properly laid for carrying rain water. The deer and antelope enclosures suffer from water logging during rain season due to improper drainage system. Drainage of moat water which was planned earlier by constructing small pumping stations is out of order. Therefore there is need for a master plan for proper drainage system by engaging one expert engineer.

In order to ensure uninterrupted power supply, ecogens of 25 KVA and 15 KVA have been installed for new aquarium and gate complex respectively. Besides these, six invertors have been provided in booking counters, zoo hospital, nocturnal house, administrative offices. There is urgent need for provision of new invertors for all Offices and also for the Reptile Park.

2 (a) (viii) Disposal of solid waste & liquid waste- sewerage

The solid waste consisting of leftover fodder and dungs of herbivores are being utilized in fodder farm after composting. The plastic & polypacks and other solid waste generated due to visitors is being dumped outside the park at safe distance place. Though sewerage lines have been provided to some parts of the zoo, this has not been provided for the entire park so far and the northern part of the zoo drains into the Kanjia lake due to its natural slope being northwards and southern parts drain into the depressions and swamps on eastern and southern boundary of the park i.e. towards Katurighasa pata and Badabanka pata respectively. New siltation tank and water treatment tanks have been provided to Hippo, Rhino, Antelope enclosures. Holistic sewerage system for the entitre park need to be drawn for better sanitation.

2 (a) (ix) Visitor amenities

The existing Boat Ghat has been renovated with new flooring and roof. **New sitouts** have been constructed in boat ghat. The boat ghat has been privatized from 2007 to enhance the revenue

and reducing the frequent maintenance and inspection. Life jackets are being provided to visitors availing boating facility. In order to maintain clean water in Kanjia lake for boating purpose, bamboo barricade has been provided to prevent floating salvinia weed.

There are five **toilet complexes** in the park for the visitors along with two special toilets for the physically challenged persons. Toilets have also been provided in the newly constructed Gate Complex in the Entrance Gate. There is a need for construction of modern toilet complexes near parking area and near Reptile Park. At present the toilets in gate complex are declared as paid toilets. All toilets are being maintained by one NGO named "Jagruti". There is need for pay toilets for better management of toilet complexes.

There are 11 number of **resting places and rain shelters** (Including 3 on the lake view road) and around hundred numbers of benches have been provided at different points for the visitors. Four cottages for visitors and one Forest Rest House cater the day time accommodation requirements of visitors and VIPs. The existing five no. of sitouts have been renovated with better seating arrangements with tiled floor and thatched roof system to give an ethnic look. There is need for upgradation of flooring and roof of rest of the sitouts.

The **wheel chairs** for invalid and perambulators for infants are available on hire charges.

There is a **Children's Park** with different playing facilities viz. swings, slides etc. Benches have been provided for waiting parents. Sufficient numbers of trees are being maintained to provide shade during summer. However, there is a need for setting up of safe drinking water facility, one toilet and one kiosk. It is contemplated to provide modern type playing equipments as the existing equipments are out-dated.

Recently one new **aquarium** on modern lines has already been constructed and dedicated to public with effect from 04.02.2008 and the old one was closed down. There are 14 aquarias with indigenous and exotic species of fishes viz. Gold fish, African cichlids,

Angel, Piranha, Oscar, Star fish, Tetras, Trigger, Shark, Barbs, Eel, Lion fish etc.

The **toy train** was made operational in the year 1971 with the help of Railway department. The total length of track is 1.58 Km. For better management, the facility was privatized since August, 2008. It is contemplated to develop the lake side view and to provide different interesting animal exhibits along the toy train track so as to make the journey more interesting & memorable. One drinking water point has been provided recently in the toy train station with aquaguard and cooler. The platform has been renovated by putting tiles. Similarly sitting arrangement for visitors has been renovated.

There are **two safaris** in Nandankanan Zoological Park. The lion safari spreads over 20 ha. area with good forest cover. It was inaugurated in the year 1984. There are good road net work inside the safari for movement of the safari vehicles. Similarly the white tiger safari spreads over 12 ha. area with good vegetation cover. It was inaugurated in the year 1991. This is the first of its kind in World. Earlier there were three battery operated vehicles and one new City Ride bus available for safari purpose. Since it was very difficult to maintain these battery operated vehicles made by BHEL, the white tiger safari and lion safari were outsourced with effect from 4th Febraury, 2009 to private parties for smooth management.

The **aerial ropeway** was made operational from 1991. The ropeway joins the Zoological garden and Botanical garden across Kanjia lake. The total span of the ropeway is 620 mtr. It is managed by M/s Ropeway & Resorts Ltd. Kolkotta. The ropeway joins the highest points of Botanical garden and Zoological garden. The visitors can have a bird's eye view of the both sides as well as Kanjia lake. There is need for provision of safe drinking water and setting up of kiosk on both landing points.

One restaurant "Shradhanjali" is run by Orissa Tourism Development Corporation which is near the administrative office and Forest Rest House. The restaurant caters to the visitor only during zoo hours. During 2007, one "Food Court" was inaugurated and managed by one private entrepreneur. Recently another canteen is made operational by OTDC near primate enclosure. However there is need for opening small kiosk near nocturnal house, boat ghat, jaguar square and white tiger safari gate.

One **small museum** was established in the year 1996. Many good quality trophies, exhibits have been displayed for the visitors. However, there is need to construct one modern Interpretation Centre in collaboration with CEE, Ahmedabad as the existing Interpretation Centre is quite old and out-dated.

The zoo **library** was established during 1987-88 near the old aquarium. This was again renovated during 2006. The library is very spacious and has a good collection of reference books and journals on wildlife and captive breeding. However, there is a need for providing new books, journals and Xerox machine for the users. Further, better sitting facility and lighting facility need to be provided.

In order to cater the need of children, one **"3-D theatre"** was started during 2006 adjacent to small museum. Wildlife movies are being screened here. This facility have been outsourced.

One **cloak room** is available for visitors near **3-D theatre**. It has been outsourced to private party.

For smooth management, the entry and parking of vehicles inside the park premises was stopped from the year 2006. A new **parking area** has been developed adjacent and outside the park premises and privatized for providing hassle free facility for the visitors. The parking area can accommodate about 500 four wheelers and 600 two wheelers at present. There is provision of announcement facility connecting gate complex to the parking place. The parking was developed with road dividers, approach road, planting shaded trees etc. One large lily pond in the existing swampy area has been developed in between parking and gate complex. It is contemplated to create better infrastructure viz. toilet complex, safe driniking water points, drivers resting place, visitor shade, kiosks including further space for parking of more number of vehicles.

There are three two beded **cottages** and one four beded cottage with attached toilets available for the tourists for resting purpose. It is maintained by revenue section. **Forest Rest House** (FRH) is maintained for official use. Many internal roads have been black topped during last few years. However, the road along the Kanjia lake i.e. from cottage to the boat

ghat need to be developed as a concrete road as the existing road is submerged during rainy season. The visitor paths in some enclosures have been paved. There is proposal for developing visitor path and stand off barrier for all animal enclosures.

2 (a) (x) Lawn and Gardens- Landscape section

The lawn & garden section is managed by one Range Officer, one Forester, one Forest Guard, one mali and fifteen labourers (EPF registered). The lawns and gardens are maintained by supplying water from Kanjia lake, open well etc. Sprinklers and pipes are used for watering. There are three pump sets, three mowers, two hedge cutters for maintaining lawn & gardens. New lawns have been developed near Boat Ghat area, Forest Rest House (FRH), Zoo Library, Gharial pool, mugger pool and water Bird Aviary for the visitors. Necessary seating arrangements with shade, dustbins, drinking water facilities have been provided. There is one nursery for raising the garden plants. Development of landscapes, lawns & gardens are the key for visitor enjoyment inside Zoological Park. Already 11 lawns and gardens have been developed over 12 hectare area in strategic locations. The lawns are being maintained by sprinklers and lawn mowers.

2 (a) (xi) Other section peculiarity to the zoo

Revenue section- It is headed by one Forest Range Officer for ensuring proper collection and checking of revenue from different sources. He is also responsible for monitoring different activities in ticket booking counters, gate complex, checking of tickets in entry check gate etc.

Special Project section- It is headed by one Forest Range Officer who take up various repair and maintenance work of buildings, maintenance of vehicles etc.

2 (b) <u>Collection Plan</u>

Nandankanan zoo started with the animals and birds which are housed at Khandagiri in Bhubaneswar during 1959-60. Initially, they were housed in Nandankanan zoo in cages and small enclosures. Gradually the stock increased after the animals and birds were purchased from animal dealers, collected from various divisions of the State and on exchange programmes.

With the implementation of Wildlife (Protection) Act, 1972 and establishment of Central Zoo Authority in 1992, various regulations came into force for animal collection. At present,

animal exchange programme is being carried out by following existing rules and regulations. Further, rescued animals are being brought to zoo for treatment and rehabilitation. However, they are only taken to stock after getting permission from Chief Wildlife Warden and Central Zoo Authority as per requirement. Animal collection from wild has been strictly prohibited.

The present practice of procurement of animals of the plan is being followed as per master plan prepared during 2001 for the period 2001-2020. the same animal collection plan is appended herewith.

Mammals		**Birds**	
Indigenous	**Exotic**	**Indigenous**	**Exotic**
Indian fox	Giraffe	Great Indian Hornbill	Ostrich
Wolf	Orangutan	Grey Hornbill	Crowned Crane
Wild dogs	Cheetah	Flamingoes	
Clouded leopard	Llamas	Storks	
Fishing cat	Eland	Cranes	
Leopard cat	Kangaroo	Munias	
Smooth Indian Otter	Wallabies		
Hogdeer	Gnus		
Mousedeer	Kudus		
Chinkara	Mirabous		
Flying squirrel			
Hoolock gibbon			
Golden langur			
Slow loris			
Reptiles			
Tortoises	Turtles	Iguana	Crocodiles

N.B.- The above list is neither exclusive nor compulsory. The collection should be finalized by the Director, Nandankanan Zoological Park on availability of suitable animal, its housing and other considerations at a given time.

2 (c) <u>General zoo administration section</u>:

There is one administrative office at the zoo housed in semi-permanent building with Asbestos sheet roof and is very old. This structure is to be demolished and a new RCC building is to be constructed with adequate space and ventilation. The VHF room, toilet facility, store room, drinking water facility are to be provided in administrative building.

Director in the Rank of Conservator of Forests is in over all charge of the Zoological Park. He is assisted by one Deputy Director, one Assistant Director, three Zoo vets, eight Forest Range Officers and other field and office staff. The veterinary section is headed by one Senior Veterinary Officer and assisted by two Veterinary Assistant Surgeon, one Live stock Inspector and other staff. There is shortage of Forester, Forest Guards and animal keepers and other permanent staff in the zoo. The vacant posts need to be filled up for smooth functioning of the

park. There are 130 EPF daily wagers working inside the park in various sections. There are different ranges viz. Animal & Sanctuary Management, Security, Stores, Revenue, Special Project etc. for carrying out specific works, each section is headed by one Forest Range Officer.

The existing administrative building is inadequate and need expansion to accommodate other officers and to carry out various activities of the park.

2 (d) Research:

Though structured research activity is not directly done by the zoo staff, researchers from the various universities are engaged for carrying out research on different aspects of animal behavior, ecology, biology, disease etc. Besides these, enclosurewise observations are recorded for future reference. Large numbers of scientific and semi-scientific papers in different national and international journals have credited to this zoo and for this to a great extent credit goes to Dr.L.N.Acharjyo, thethen Veterinary Officer who served the zoo for nearly 3 decades. Few Ph.Ds have been awarded on research work as captive animals of Nandankanan Zoological Park.

Under small grants programme, the Central Zoo Authority (CZA) has approved a research project titled "Project on ecto and endo-parasites of captive animals & birds of Nandankanan Zoo" which implemented from April; 2007. The project is being undertaken in collaboration with Orissa Veterinary College. The project would be completed by March, 2010. Based on the out puts of the project, a protocol can be developed for effective management of parasite of the captive animals and birds. The Indian Pangolin Conservation Breeding Centre has been established during 2009 in NKZP. The construction of Vulture Conservation Breeding Centre in NKZP is under progress.

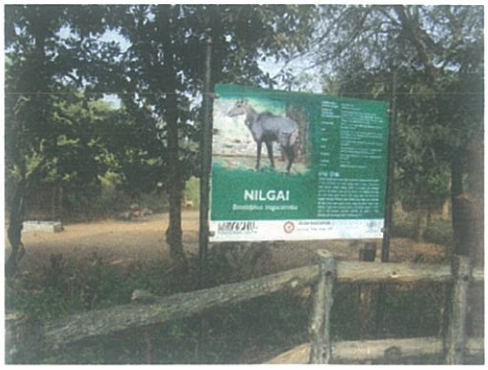
2 (e) Conservation Breeding

NKZP promotes itself as an institution that can be utilized in every possible way to compliment the *in-situ* conservation. It has the distinction of being the first captive breeding centre where Gharials were bred successfully in captivity in 1980. More than 700 Gharials reared in the breeding centre of NKZP have been released in to their natural habitat. Conservation breeding has been a major thrust of NKZP. It has also the distinction of successful rearing and captive breeding of threatened species like Indian Pangolin *(Manis crassicaudata)*. Recently a customized breeding enclosure is designed with appropriate enrichments. Nandankanan is all set to establish a Vulture Conservation Breeding Centre soon. The centre would be set up in collaboration with the Bombay Natural History Society with funding support from CZA.

NKZP is well known for breeding of white tigers in the world. Many white tigers have been sent to various national and international zoos on animal exchange programme. The zoo has successfully bred many indigenous species viz. Himalayan Black Bear, Black Panther, Sloth bear, Sambar, Barking Deer, Mousedeer, Swampdeer, Manipur deer, Indian Pangolin, Common peafowl, Tiger, Blue bull and exotic species viz. .Zebra, Hippo, Chimpanzee, Wallaby, Hamadyas baboon, Emu. The zoo has a long history of successful captive breeding of different critically endangered species.

2 (f) <u>Education and awareness</u>:

In a modern zoo, education is very important and NKZP has also contributed its bit in this respect. While educational signage on different animals, brochures and guide books have been published from time to time. Earlier wildlife film shows were also organized for which 16mm films are available in the park. There is a library inside the park with a large number of books and periodicals on wildlife.



Conducted tours of students are organized on different occasions viz. Wildlife Week, Elephant Day, World Wetland Day, Van Mahotshav, birth day of tigers and competitions are also organized among school children and zoo keepers. Researchers and students from the universities and colleges also make use of the zoo and its facilities. Course for zoo Directors and middle level zoo personnel have been organized in the past with the support from the Central Zoo Authority. It is recognized as centre for training of zoo keepers of eastern Indian zoos. The zoo keepers from Delhi Zoo are being trained on zoo management during 2009. Officers are being sent to attend capsul courses on zoo management organized by CZA & Wildlife Institute of India. The zoo veterinarians are being sent to attend various training courses on animal treatment and management.

There is a system of registered guides in the park who have been trained and their services are being used by the visitors. Besides, there are also guides who come with conducted tours from Puri, have been duly trained. Training programme for registered Guides is also conducted from time to time to update their knowledge on captive animals in collaboration with Centre for Environment Education, Bhubaneswar and Indian Institute for Tourism & Travel Management (IITTM), Bhubaneswar.

Education and outreach programme have been the priority of the zoo. Keeping this in mind, the education programme is upgraded to make it more pragmatic. To draw the attention of the visitors, the education programme is designed with a different flavour.

Nandankanan Zoo School was formally opened on 29th December, 2003 (on the occasion of 44th Foundation Day of Nandankanan Zoological Park). The first issue of Newsletter of Nandankanan Zoo School, named "Panchatantra" was released on this occasion. It is being published regularly once a year. So far six issues of "Panchatantra" have been brought out.

Kanjia lake, like a jewel on the crown spreads over 66.1 hectare is a unique wetland with rich floral and faunal biodiversity. It is included as a wetland of national importance by the Ministry of Environment and Forest, Government of India with effect from December, 2006. The wetland is strategically positioned for promoting wetland education. The celebration of World Wetland Day on 2nd February is being done in this zoo since 2007 in collaboration with one NGO "Pallishree" where school children are involved awareness programme. Film shows on wildlife, drawing and quiz competition is being conducted.

Students from Orissa University of Agriculture & Technology (Forestry & Veterinary) regularly come to NKZP for their internship. Many scientists, researchers, trainees from various Forestry & Wildlife schools and colleges visit to this zoo for learning *ex-situ* conservation. The M.Sc. students from The Engery Research Institute (TERI) University, New Delhi had come during 2007 & 2008 for their M.Sc. dissertation. The Non-Government Organization (NGOs) and volunteers conduct special awareness programme in this zoo.

2. (g) Any other activity peculiar/unique to the zoo

Adoption of animals

In line with such unique steps, the most recent scheme that has caught the imagination of conservationists is the novel Adopt-an-Animal programme. As per the scheme, any animal-loving individual or institute can adopt any number of species from the captive animals, birds and reptiles in the zoo, by extending support for one year or multiples of month. The amount would go towards providing nutritional food, medical care and upgradation of enclosure. The adopted animal would continue to remain in the zoo under the care of zoo professional; however, the sponsor, to be known as Foster Parent, can visit and check on the funds getting channelized into better care and tending for the adopted animal.

Nesting of Open bill storks

Open bill storks started nesting in Nandankanan after super cyclone of 1999. The trees within and around Gharial & Mugger pool had provided most ideal habitats for the establishment of heronry during 2000. The place was teeming with avian species viz. Open bill storks, Little Cormorant, Night herons, Egrets etc. by the last week of May'2000. With the onset of monsoon, the nesting activity attained its peak. The fledglings grew and became adults by October. They left the nesting site towards end of October. This cycle is continuing year after year. The open billed storks have also started nesting on the area adjoining to Kanjia lake since 2008.

The Open billed stork nesting in Nandankanan has provided a bewildering experience to its ever-growing visitors, naturalists and wildlife lovers.

Relocation of staff colonies

Presence of staff colonies inside Nandankanan Zoological Park creates much disturbance for the tranquility of the zoo environment. There is urgent need to relocate these staff colonies outside the park in the acquired area for better management and also for security reasons.

PART-II

CHAPTER-I

FUTURE OBJECTIVE INCLUDING MISSION STATEMENT/THEME

1. The future objectives and activities proposed is based on the **Concept Plan** approved by CZA- The following concept plan of Nandankanan Zoological Park has been approved by CZA vide their letter No. F No.19-64/92/CZA(212) Vol.V (M) dtd. 10.02.2009

Sl. No		
1.	Name of the zoo	Nandankanan biological park, Bhubaneswar
2.	Category of the zoo	Large zoo
3.	Area of the zoo	362.1 hectare
4.	Objective	I. Conservation breeding of Pangolin, Mousedeer, Vultures, Tiger, Gharial and other wild animals species of Eastern India. II. Research for conservation of wildlife in captivity. III. Conservation education and awareness. IV. Rescue and rehabilitation of Leopard, Sloth bear & Monkey.
5.	Theme of display	Broad taxonomic display of wild animals species of national importance with special emphasis on fauna of Eastern Ghats.
6.	Animal Collection plan	I. Wild animals species of Eastern ghats, Eastern India and those of national importance in the same order. II. Off display conservation breeding centre for pangolin and vultures. III. Rescue Centre for Leopards, Sloth bear and Monkeys. IV. Lions, White tigers and Herbivores Safaris. V. Nursery for the orphaned young's and sterilization centre for Monkeys.
7.	Master (Layout) Plan	To be prepared keeping in view of the above.
8.	Manpower	I. Full time Director in the rank of CF II. DCF level curator, animals-1 no III. Veterinary Officers-2 nos.

		IV. Education Officers-1 no. V. Biologist-1 no. VI. Support staff as per needs.

1.1 Objectives

i. To made conservation breeding of various species with emphasis on endangered species belonging to the region for preservation of biodiversity.

ii. To facilitate research and scientific study on animal behaviour, enclosure enrichment, feed and nutrition and reproductive biology.

iii. To prmote education and awareness amongst visitors towards conservation of wildlife

iv. To ensure housing of captive animals and birds with special emphasis on health care, ethical standards, animal welfare and excellent animal husbandry.

v. To provide holistic environment for rehabilitate of wildlife including leopard, sloth bear and monkeys.

1.2 Mission statement

"To achieve the distinction of an Outstanding Zoo through World Class Conservation, Education, Research and Exciting visitor experiences by connecting people to biodiversity conservation".

1.3 Strategy for achieving the objectives

It is proposed to adopt the following strategies to achieve the above objectives.

i. **Conservation breeding:** Nandankanan Zoological Park is well known for successful breeding of white tigers as well as normal coloured tigers. Considering the importance for future reintroduction of captive bred tigers into the wild after following IUCN guidelines, it is proposed to take up planned breeding of tigers by broadening the existing gene pool.

The zoo is also globally known for first successful captive breeding of endangered gharials. There is need for expanding existing captive breeding facility so as to reintroduce gharials in its former habitats.

Nandankanan Zoological Park has already started conservation breeding centre in off-display area for highly endangered species viz. white backed vulture (*Gyps bengalensis*), Indian Pangolin (*Manis crasicaudata*) and Mousedeer (*Tragulus meminna*). It is proposed to take up captive breeding programme of some endangered but lesser known species of the region viz. Fourhorned antelope or Chowsingha, Water Monitor

lizard, Hornbills, Ratel etc. Further the conservation breeding of Indian Rhino, Swamp deer, Thamin deer/ Manipur deer, Liontailed macaque, Nilgiri langur, Mugger, Saltwater crocodile can be taken up by acquiring required number of animals by suitable exchange programme with national as well as international acclaimed zoo with approval of CZA. Customized breeding enclosures are to be designed to stimulate and meet the biological needs of the target species for successful conservation breeding programme. It is proposed to have conservation breeding programme with co-operative population management and co-ordination at regional, national and global level.

ii. **Research & Scientific study:** Pragmatic research activities are a must for zoo from its own resources as well as in collaboration with institutions premier research of great repute. There is great scope to facilitate research and scientific studies on environmental enrichment, animal behaviour, control of various diseases, nutritional study and reproductive biology of captive animals.

NKZP has taken up one research project titled "Ecto & endo-parasites of captive animals & birds of Nandankanan zoo" under small grant programme of the Central Zoo Authority (CZA). The three year project is being under taken in collaboration with Centre for Wildlife Health, Orissa Veterinary College since 2006. Based on the findings of the project, a protocol would be developed for effective management of parasites in this park as well as in other in Indian zoos.

Coordinated planned breeding programme of endangered species and reintroduction programme will be taken up based on sound research activities. Frontier research activities are needed for prevention and control of dreaded diseases viz. Feline-pan-leucopenia, Ehlicosis etc. in carnivores. Further research is needed for reintroduction of captive born animals to wild viz. gharials, Indian pangolin, deer etc.

In order to have sustained research activities in the zoo, engagement of two fulltime Biologist/Research Officer is required. A modern research unit needs to be established with adequate infrastructure and facilities.

iii. **Promotion of wildlife education and awareness:** In order to provide enlightened wilderness, all targeted group of visitors need to be reoriented towards conservation of wildlife. Proper wildlife education and awareness can be promoted trough systematic display of animals in their near natural habitat, with neatly designed exhibits, signages, interpretation centre, conducted tours, laying self guided trails, audio-visual aids etc.

There is a need for establishing one modern visitor/interpretation centre depicting the values of the zoo and the protected area. The will be established near the entrance of the zoological park.

Keeping the latest trends in mind, the zoo education programme need to be upgraded and designed to make it more pragmatic for the visitors so as to understand the role of *ex-situ* conservation. In order to give a different flavour innovative ideas viz. Birth day of tigers, celebration of elephant day etc. have been launched in zoo education and awareness programme. One aquarium has been established with well researched education materials. There is a need to establish one butterfly park to enhance the values and qualities of the Park. One modern zoo school needs to be constructed infrastructural facilities. It is contemplated to have a group of personnel lead by one zoo education officer to take up this specialized job to run the zoo education programme on day to day basis. There is a need for an amphitheatre for arrangement of various educational programme.

iv. **Housing, health care & environmental enrichment:** Appropriate housing is key to planned breeding of the targeted species similarly health care is the second most important component after animal housing. Therefore, it is proposed to have high standard of animal health care and hygiene in the zoo. A set of protocol are being followed as a prophylactic measure against the dreaded diseases viz. Tryponosomiasis, Feline-Pan-Leucopenia and other blood borne parasitic disease. The health conditions of zoo animals are being monitoredon daily basis. Although the zoo has all basic infrastructures yet there is urgent need for modernization of isolation unit.

Environmental enrichment for captive animals needs to compensate the deficiencies of the having system. The planning aims to provide maximum of activity and behavour choices for the animals that is being kept in a particular enclosures. It is proposed to consider location layout, features of exhibits and relations between exhibit parts for all existing enclosures to meet the deficiencies.

The challenge of a zoo nutrition programme is to provide optional nutrition to be animals in its care, while attempting to address the psychological needs associated with the behaviour of feeding. Determining requirements, basic ingredients, palatability, presentation, novel food items or enrichment, training reverend, food as a medication for oral medications, intake and social group dynamics effect or intake, and a myriad other factors are be identified, communicated and continually assessed.

v. **Capacity building:** It is always desirable to have capacity building programme for front line staff of the zoo. There is need to have professionally skilled manpower and require upgradation of professional success of the establishment. Human resource development planning is very important for the growth of the zoo and holistic management of the captive animals.

The zoos have to take advantage of various short-term training for zoo managers and zoo veterinarians, conducted in collaboration with Wildlife Institute of India, Dehradun and Indian Veterinary Research Institute, Izatnagar (UP) and CZA. Zoo keepers training is also being organized every year with the support of Central Zoo Authority.

1.4 Strategic planning

The future action plan is aimed to provide direction for development of the zoo in coming 10 years i.e. 2009-10 to 2018-19. The proposal is based on the topography of the site, water availability, vegetation, climate, visitors profile, conservation, education and research needs and convenience of management. For convenience, the proposal has been prepared section-wise. The recommendations of the Central Zoo Authority during the evaluation of the zoos from time to time has also been kept in view while formulating the proposal for new structures or modification of existing structures.

1.5 Animal Section:

The animal section is the most important part of any Zoo. For locating the enclosure various aspects like topography and vegetation needs to be kept in mind for different species depending upon their habits. The display will also depend on management convenience.

The maximum number of any species to be displayed would depend on their social behavior based on which adequate space for the individual or social group would be provided. The enclosure should be designed to take care of the biological need of the species with carefully planned enclosure enrichment, its safety and proper viewing by the visiting public.

While attempts shall be made to provide open-air enclosures for most of the species with dry or wet moat barrier, other types of barriers like chain-link mesh fence, glass or wall shall be used wherever felt more appropriate.

All enclosures shall be designed in a manner to provide adequate protection to the animals against climatic variation to commensurate with the individual need of the species with appropriate enclosure enrichment. Adequate attention has to be paid for provision of kraals or isolation arrangements for protecting individuals or groups from aggressive behaviour of individuals in the group, protection of pregnant, injured animals and young ones. Such separation will help in elimination of any problem of infighting, cannibalism or rejection. Wherever possible in-built squeeze cages should be attached to animal houses or sets of animal houses for restraining the animal for providing treatment and when necessary without putting the animal to undue stress for capture or transport to the zoo hospital. Each animal house should be provided with adequate drainage facilities so that the liquid wastes are drained out of the enclosures and disposed off without contaminating the surrounding enclosures. There should also be arrangements for cleaning the solid wastes and their disposal, without any risk to the animals or conservancy staff. Potable water supply should be ensured to all animal enclosures and feeding cubicles preferably from deep tube well.

It is proposed to procure new species during next ten years. Indigenous mammals viz. Bison, Indian fox, Wolf, Wild dog, Clouded leopard, Fishing cat, Leopard cat, Smooth Indian otter, Chinkara, Flying squirrel, Hoolock gibbon, Golden langur, Slow loris need to be procured. Further indigenous birds viz. Vultures, Hornbills, Flamingoes, Cranes, Storks, Hill mynah etc. need to be procured. The zoo has experience of keeping exotic animals viz. Wallaby, Capybara, Marmoset, Ostrich etc. Further exotic animals like Orangutan, Potas monkey, Squirrel monkey, Emu, Cassowary etc. need to be procured for pairing. New exotic animals viz. Giraffe, Cheetah, Llamas, Eland, Kangaroo, Yellow baboon, Iguana, Nile crocodile, Aligator, Galapogos tortoise, pheasants, lorries, macaws etc. need to be procured for display.

1.5.1 Animal enclosure

While setting of enclosures for different mammals, birds and reptiles, their ecology and habitat condition were considered. Accordingly adequate space was set-aside considering their social behaviour, biological requirement and physical wellbeing. The natural topography and vegetation was maintained as such with little modification as per requirement. Most of the

carnivores, primates and some of the herbivores are being provided with large open air enclosures with dry and wet moat barriers. In some cases barriers like chainlinkmesh fence or glass or wall have been provided. For future developments viz. creation of new enclosures, it is proposed to develop some enclosures with immersion effect. Further all the existing sunken enclosures for primates need to be converted to island type wet moat enclosures.

At present all carnivore enclosures have appropriate feeding cubicles. Whenever needed the carnivore can retreat into the kraal or feeding cubicle and maintain a safety distance from the visitors. The feeding cubicle-cum-night quarters have adequate protection against climatic variations, commensurate with the individual requirements of the species viz. Boulders, caves, vegetation, platform, logs etc. In Barking deer enclosure boulders have been arranged so as to provide adequate space and cover for fawning young ones. Similarly for sambars wallowing pools have been provided. The leopards are very fond of climbing trees and feeding on raised platform. Therefore, individual requirements vary and accordingly adequate provision of enrichment needs to be provided.

The carnivores have been provided with buffalo meat inside feeding cubicles. However, it is seen that most of the tigers and leopards like to bring the buffalo meat pieces to the exhibit area or kraal and consume the same. Recently a few tigers have been practized to feed inside the feeding cubicle only so as to prevent problems due to scavenging birds and mongooses. It is proposed to provide stainless steel embedded troughs for drinking water.

Similarly the temporary thatching cover done over water tanks in tiger enclosures pollutes the water below in case of rains. The tigers love to spend long hours in water tanks during summer and early part of monsoon which need to be provided with permanent shed which would be merging with the surrounding environment.

Cemented platform with feeding troughs need to be provided for herbivores to reduce waste of dry feed and tree fodder and grass due to trampling. If mechanical chaffer would be used for placing chaff in feed trough, it would be very good for herbivores.

The bears, primates etc. to be provided with removable stainless steel drinking troughs which would be kept temporarily fixed to a seemingly embedded cemented structure. This would facilitate easy cleaning and maintenance.

The existing floors in most of the animals are made of cement and without provision of proper slope for drainage. The drains are not upto marks and are difficult to maintain. It is proposed to provide tile on the floors to facilitate easy cleaning. The existing quarantine and bear

feeding cubicles do not have good ventilation for which the floors always remain damp. Provision of electricity is needed for quarantine, white tiger and lion safari feeding cubicle and bear enclosures. Inbuilt squeeze cages have been provided in most of the enclosures. However, there is further need for augmentation, proper maintenance of all sliding doors, squeeze cages etc. are badly required. Painting of chainlinkmesh, angle iron at regular interval is needed to enhance the strength and durability.

In order to maintain proper hygienic condition, the cemented water troughs in birds have been replaced with glass wares. However there is still some deficiencies and both feeding platform/feeing bowl and drinking water troughs to be replaced with glass wares.

The existing isolation arrangement for aggressive or sick herbivores is not adequate. Specific design needs to provided with required equipments to capture or restrain the desired animals.

It is proposed to construct enclosures for the new species during next ten years. Enclosure for Giraffe, Potas monkey, Squirrel monkey, Emu, Cassowary, lorries, pheasants, macaws, crocodiles, are already available.

1.6 Disinfection schedule

Upkeep of captive animals in zoo depends upon general cleanliness of the enclosures, animals as well as the zoo keepers. The following regimen of cleaning and disinfection is proposed to be carried out in Nandankanan zoo.

a. Daily- (1) Removal of fecal matter, leftover bone of carnivores and fodder of herbivores, cleaning of floor of feeding cubicles, kraal, corridor, passage and exhibit area.

(2) The feeding place and water trough etc. to be cleaned with bleaching powder.

(3) Drains to be cleaned with diluted phenyl.

(4) Removal of plastic, polythene and unwanted materials from exhibit area and moats.

(5) Kohrsolin to be sprayed in intensively used zones.

b. Weekly- (1) Pest control measures to be taken in and around feeding cubicle.

(2) Deweeding to be carried out in and around enclosures followed by spraying of Kohrsolin.

(3) Keeping the exhibit area and moat free from debrises.

(4) Drains to be treated with lime and bleaching powder.

(5) Feeding cubicles to be cleaned with potassium permanganate.

c. Monthly- (1) Leftover bones in bone pits to be lifted and the bone pits to be treated with K-orithene.

(2) All big cats to be sprayed with Acaricide (cypermethrin etc.) and also the enclosures.

(3) Monthly burning of all debris to be done in exhibit/display area whenever required. Liming to be carried out in and around enclosures.

(4) Kohrsolin as ground spray is to be carried out in and around enclosure.

(5) Water purifier i.e. Sokrena WS to be treated to all water storing areas.

d. Bi-monthly- (1) K-orithene to be sprayed just after deweeding in two months interval.

(2) All wet moat water to be pumped out, desilted, lime washed and then filled with fresh water.

e. Half yearly- (1) All feeding and drinking troughs are to be white washed.

(2) All floors, walls, roof, transporting cages, netting, rods to be flamed sterilized (March & November every year)

f. Annually- (1) Removal of top soil upto 6" in all kraals and intensively used. Pacing areas and filling with fresh sand and soil.

(2) All walls, roof top both inside and outside to be lime washed.

(3) All chainlinkmesh, angles of enclosures and animal cages, sliding doors, squeeze cages etc. to be painted.

Note- A definite protocol mentioning all schedule are to be displayed in zoo hospital and Administrative office.

1.7 Miscellaneous

(a) Foot bath- At present foot baths are being maintained at the entry of feed receiving centre, isolation unit, white tiger safari feeding cubicles, lion safari feeding cubicles etc. Foot baths are being constructed in the entry point of small mammal. However, foot baths are to constructed and maintained in entry of zoo hospital, quarantine unit, all carnivore enclosures, herbivore enclosures, nocturnal house, zoo kitchen feed store etc. These are to be maintained by putting appropriate disinfectant.

(b) Rodent and snake control- Bird enclosure No. 1 to 12 are severely infested with rodents. The wild bandicoots even dug out floor and kill birds. In order to feed on small birds and rodents often snakes from near by jungles sneak inside the bird enclosures. It is badly required to put ½" size chainlinkmesh instead of existing higher mesh size. In order to enhance

the visibility, all the chainlinkmeshes are to be painted with black paint. Similarly, all the floors are to be concretized with chainlink nettings to prevent rodent damage. The feed store also needs to be protected against rodent attacks.

(c) Mongoose problem- These are found plentily inside the zoo and often enters carnivore enclosures to feed on leftover buffalo meat. They also sneak into bone pits and birds of prey enclosures in search of buffalo meat, fish etc. Since these are potential vermins, measures need to be taken to prevent their entry into these enclosures.

(d) Tabanid fly trap- Tabanid flys are vector for Tryponosomiasis diseases in large cats and lesser cats. They are reportedly affecting other species viz. zebras and hyenas also. In order to monitor their population, Tabanid fly traps have been fixed in most of the carnivore enclosures, near zebra and small mammals, hyena, sambar and nocturnal house. Regular monitoring of vector population is required inside park for control of the Trypanosomiasis diseases. Seasonal data on vector population is to be recorded and monitoring to be done from time to time.

(e) Herbivore enclosure- Liming is to be done before onset of monsoon during monsoon, and post monsoon to reduce the outbreak of FMD inside the herbivore enclosures. Nandankanan zoo has a record of FMD outbreak for last many years. After systematic disinfection schedules for last two years, the incidence of FMD has been under control. Similarly TB medicines are being given to all herbivores which have substantially enhanced the body immune system and TB has been controlled for last two years.

Note- In order to prevent development of drug resistance the type of disinfectants need to be changed periodically. Health camps are being arranged from time to time for all animal keepers and staff to prevent zoonosis and gloves and other equipments for carrying out their duties inside animal enclosures. it is proposed to provide a small room for keeping their dresses, equipments and adequate quantitaties of soap, disinfectants to be provided to maintain personal hygienie and to prevent diseases.

1.8 Education & Awareness

The world zoo conservation strategy emphasizes that the use of a variety of educational techniques, facilities and considerations, together with knowledge, creativity and inventiveness can make zoos highly interesting, attractive and effective places for environmental conservation and holistic life system education. Zoological garden provides an opportunity to open up a whole

new world of curiosity and interact and sensitize visitors regarding the value and need for conservation of wildlife.

(a) **Interpretation Centre**- One modern visitor/interpretation centre will be established The thrust areas are (i) to provide a pre-visit orientation to the visitors as well as to function as an education centre of the zoo (ii) providing interpretive facilities for visitors coming to the zoo viz. on-site information through signages, wayside exhibits facility signs and zoo maps (iii) developing publications and relevant zoo literature viz. zoo brochures, guides, manual, handbooks etc. These could serve as good learning material for students and teachers and also provide interesting information for other visitors.

(b) **Establishment of a zoo school**- At present there is no permanent building for running the zoo school. Although the school is formally established in 2001yet there is no such activities except publishing one Newsletter during zoo foundation day. Once the building is being constructed, regular zoo school programmes can be run. The zoo school must have a mini theatre with all modern audio-visual equipments viz. LCD projector, organizing training programme which must aim at skill development for education in zoo for zoo staff. The challenges while organizing these programmes have been catering to the diversity and variety of audiences and the multilingual nature of these programme.

(c) **Animal adoption**- This is quite interesting and with lunching of animal adoption we can attract scores of nature lovers, students, large enterprenures and companies for caring the zoo animals.

(d) **Enclosure signages**- The quality of existing enclosures signages can be enhanced. These are to be visually attractive and communicative as well as interactive exhibits which do not necessary need people to read.

(e) **Nature trails** - Two different nature trails viz. one is representing topography and vegetation and another representing wetland ecosystem to be laid out with good quality interpretive designs.

(f) **Other educational tools** and technique to be included one specially designed programmes for school and college groups, which help them and understand curriculum-related concepts viz. celebration of Birth Day of tiger, Wildlife Week, Elephant Day, World Forestry

Day, Animal Welfare Fortnight, World Wetland Day, World Environment Day, Van Mahostava, Zoo Foundation Day etc. and outreach programme viz. School visits, training programme, special conservation programmes, workshop, seminars, quiz competition, drawing, essay and debate competition etc.

(g) **Nature shop/Souvenir shop-** The existing gift cum nature shop is being run in collaboration with WWF-Orissa branch. However the shop needs modernization. Various handouts can be developed with respects to birds, amphibians, reptiles, wetland ecosystem, butterflies and flora of Nandankanan zoo.

(h) **The zoo in collaboration with** CEE and WII can organize three-day module on zoo education and interpretation for school and college students for middle level zoo personnel, zoo volunteers, teachers, NGOs. The manual developed by CEE for teachers entitled 'Wild' at the zoo.

(i) The existing **library in Nandankanan zoo** is well equipped. However, it needs to be modernized further by upgrading some facilities viz. installation of software "Libsis" with internet facilities. One can Xerox required documents with a Xerox machine and also can download data from internet. Proper sitting and studying arrangement need to be done with better ventilation and lighting facilities. The landscape around library to be further developed to make it a attractive centre for learning. Good quality journals relating to conservation breeding ecology and behaviour of captive animals to be procured on regular basis. All the publications relating to NKZP need to be kept separately for reference. New books and journals need to be purchased from time to time.

(j) **Botanical names of all trees** with common name and local name species within the park will be displayed trees adjoining to nature trails, foot paths and roads.

(k) Adequate **directional signages**, do's and don'ts etc. to be provided. The self guided routes to be displayed properly. Routes indicating animals to be seen with approximate time to be covered must be indicated for the benefits of the tourists.

(l) **Training of zoo guides-** Nandankanan zoo has many trained and registered guides. Systematic guide training

PART-II

CHAPTER-II

FUTURE ACTION PLAN

2. (a) Proposed Animal Collection Plan including population size:

Sl. No.	Name of species	Availability enclosure	Present status of population in NKZP				Proposed requirement			
Birds										
Indigenous										
			M	F	U	T	M	F	U	T
1	Indian pied hornbill	Not available	0	0	0	0	1	2	0	3
2	Great Indian hornbill	-do-	0	0	0	0	1	2	0	3
3	Flamingo	Available	0	0	0	0	4	4	0	8
4	Lesser Adjutant srork	-do-	0	0	1	1	1	2	0	3
5	Painted Storks	-do-	0	0	1	1	4	4	0	8
6	Whitenecked stork	-do-	1	0	0	0	2	2	0	4
7	Sarus Cranes	-do-	0	0	2	2	2	2	0	4
8	Blackheaded Munia	-do-	2	2	0	4	5	5	0	10
9	Spotted Munia	-do-	2	2	0	4	5	5	0	10
10	White European Spoonbill	-do-	0	1	0	1	5	5	0	10
11	Bloosmheaded parakeet	-do-	0	0	6	6	3	3	0	6
12	Nicobar pigeon	-do-	1	0	0	1	3	3	0	6
13	Hill mynah	-do-	0	0	0	0	3	3	0	6
14	White backed vulture	Not available	0	0	0	0	3	3	0	6
15	Pariah kite	-do-	0	0	3	3	2	2	0	4
Exotic										
1	Ostrich	Available	0	0	0	0	2	2	0	4
3	Hyacinth macaw	Available	0	0	0	0	2	2	0	4
3	Rainbow lorry	Available	0	0	0	0	2	2	0	4
4	Bhutan grey pheasant	Available	0	0	0	0	3	3	0	6
5	Golden pheasant	-do-	0	1	0	1	3	3	0	6
Reptiles										
Indigenous										
1	Mugger	Available	0	0	3	3	2	2	0	4
2	Saltwater crocodile	-do-	0	0	3	3	2	2	0	4
2	Indian Tent turtle	-do-	0	0	0	0	2	2	0	4
Exotic										

1	Green Iguana	Not available	0	0	0	0	2	2	0	4
Mammals										
Indigenous										
1	Indian Pangolin	Available	2	2	3	7	1	1	0	2
2	Ratel	-do-	1	1	0	2	2	2	0	4
3	Flying squirrel	Not available	0	0	0	0	2	2	0	4
4	Golden langur	-do-	0	0	0	0	2	2	0	4
5	Indian fox	-do-	0	0	0	0	2	2	0	4
6	Wolf	-do-	0	0	0	0	2	2	0	4
7	Wild dog	-do-	0	0	0	0	2	2	0	4
8	Clouded leopard	Available	0	0	0	0	1	1	0	2
9	Fishing cat	-do-	0	0	0	0	2	2	0	4
10	Leopard cat	-do-	0	0	0	0	2	2	0	4
11	Smooth Indian otter	-do-	0	0	0	0	2	2	0	4
12	Hogdeer	-do-	2	2	4	8	1	1	0	2
13	Mousedeer	-do-	1	0	0	1	2	2	0	4
14	Chinkara	-do-	0	0	0	0	2	2	0	4
15	Hoolock gibbon	Not available	0	0	0	0	1	1	0	2
16	Slow loris	Available	0	0	0	0	2	2	0	4
17	Wild ass	-do-	0	0	0	0	2	2	0	4
18	Jungle cat	-do-	0	0	0	0	2	2	0	4
19	Nilgiri langur	-do-	1	0	0	1	2	2	0	4
20	Assamese macaque	-do-	1	0	0	1	2	2	0	4
21	Liontailed macaque	-do-	1	0	0	1	2	2	0	4
22	Indian one horned rhino	-do-	1	0	0	1	1	2	0	3
23	Asiatic lion	-do-	0	0	0	0	2	2	0	4
24	Giant squirrel	Not available	0	0	0	0	3	3	0	6
25	Bats	Available	0	0	0	0	5	5	0	10
26	Gaur	-do-	0	0	0	0	3	3	0	6
Exotic										
1	Giraffe	-do-	0	0	0	0	1	2	0	3
2	Zebra	-do-	1	3	0	4	2	2	0	4
3	Hippopotamus	-do-	3	6	3	12	1	1	0	2
4	Jaguar	-do-	0	0	0	0	1	2	0	3
5	Lemur	Not available	0	0	0	0	1	1	0	2
6	Kangaroo	-do-	0	0	0	0	2	2	0	4
7	Orangutan	Available	0	1	0	1	1	1	0	2
8	Wallaby	-do-	0	0	0	0	2	2	0	4
9	Yellow baboon	-do-	0	0	0	0	2	2	0	4
10	Hamadryas baboon	Available	1	2	1	4	2	2	0	4
11	Marmoset	Not available	0	0	0	0	4	4	0	8

2. (a) i. Abstract of animal collection plan

Sl.No.	Animal groups	Exotic	Indigenous	Total
1	Birds	5	15	20
2	Reptiles	1	3	4
3	Mammals	11	26	37
TOTAL				61

Justification of keeping the endangered species-

The above animals proposed in animal collection plan because.

1. The zoo has the experience of keeping these species in the park.
2. The technical knowhow of management of this proposed animal and birds is available in the park.
3. The climate and environment of park is suitable for maintenance of these animals.
4. Space is available for construction of new enclosures for the proposed species.
5. The animals will be procured to pair with the single sexed animals of the park.
6. Some of the animal proposed in the collection plan will be additional attraction for the visitors under education and awarness programme.
7. To prevent in-breeding and to introduce fresh blood.

Collection Plan:

The location of this open air zoo is ideally situated to breed and exhibit Indian fauna of tropics. Recognising the importance of large zoos in providing nature education as well as their role in scientific research on different aspects of wild animals, emphasis has to be given to display Indian fauna with special reference to those belonging to the region. Considering the conservation importance of some little known small mammals like Indian pangolin, ratel, mouse deer, Malabar giant squirrel or flying squirrel and different species of snakes needs to be included in the collection plan and be exhibited. The zoo has the past experience to handle these animal species of the region and they play significant role in education as these endangered species being more secretive, are rarely sighted in the wild. The zoo at present has many exotics. However, exotic species like giraffe, zebra, hippo, jaguar, puma, African lion, large apes, kangaroo, flightless birds, Psittacines like macaw, cockatoo etc. may be exhibited for their peculiar morphological character. They are quite popular among the visitors and are easier to handle. However, top priority shall be given to pair the single animals or animals of the one sex

available in the zoo either by arranging mates for them or by transferring to other zoos on breeding loan or transfer in the interest of conservation of the species. This is very urgent in the case of endangered species of Indian sub-continent.

Conservation breeding

The zoo houses several endangered species of regional significance that include three species of Crocodiles (Gharials, Muggers and Salt water crocodiles), Pangolin, Ratel, Mousedeer, Sambar, Black buck, Tiger Leopard, Small Indian Civet, Brahminy kite, Vultures, Indian peafowl, Storks, Hill mynah, Sloth bear, Elephants, Barking deer, species of Owl, a variety of Snakes, Monitor lizards, Fresh water turtles etc. Other such species are Rhinoceros, Brow antlered deer, Swamp deer, Himalayan Black bear, Lion tailed Macaque, Nilgiri langur etc.

Nandankanan Zoological Park has been a premier conservation institution with its unique ability and commitment to effective ex-situ conservation of wildlife. Conservation breeding has been the major thrust of Nandankanan Zoological Park. NKZP is the first Indian zoo to carry out conservation breeding programme. It has the unique distinction of setting up the captive breeding center where **Gharials** were bred successfully in captivity in 1980. More than 700 Gharial successfully reared in the breeding center of NKZP have been released in their natural habitat. It has also the distinction of successful rearing and captive breeding of highly threatened species like Indian **Pangolin** (*Manis crassicaudata*). Nandankanan Zoological Park is identified as the coordinating zoo for breeding of Indian Pangolin by CZA. Nandankanan Zoological Park is also identified as the participating zoo for breeding of Tiger and Mouse deer.

The zoo is all set to establish a **white backed vulture conservation breeding center**. This is going to be a major challenging task for the park. The population of White-backed has declined by more than 97% in nature. It is apprehended that unless assisted breeding of the above three species

is adopted then there is every possibility that it may become extinct from the nature. Central Zoo Authority have approved the proposal for setting up of the vulture conservation breeding center for white backed vulture (*Gyps bengalensis*) at NKZP. Funds are being released and the center would be set up in collaboration with the Bombay Natural History Society very soon.

The core species suggested for captive breeding are leopard, elephant, brow antlered deer, lion tailed macaque, blackbuck, with emphasis on the small mammals like Indian pangolin and Mouse deer ,amongst mammalia; gharial, salt water crocodile amongst reptiles and hornbills, brahminy kite, amongst birds from endangered species. Amongst exotic successfully breeding at NKZP like Zebra, Hippopotamus, Chimpanzee, Hamadryas baboon, Cockatoos, Emu shall form the captive breeding programme. To achieve sustainable ex-situ conservation objectives, emphasis would be laid on, animal welfare, health care, ethical standards and excellence in standards of animal husbandry with emphasis on enclosure enrichments and to inflict least human imprinting.

Adjusting of surplus animals:

There were many domestic animals in the zoo. Some of them have already been phased out, but few remaining animals need to be phased out as per the guidelines issued by Central Zoo Authority vide their Letter No.19-64/92-CZA(212)(Vol.III)(M) dt.17.09.2004. These animals are kept off exhibit and would be phased out soon. Some of the captive animals viz. spotted deer, barking deer, nilgai who have multiplied beyond the carrying capacity of the zoo need to be phased out for this translocation to Chandaka Dampada wildlife sanctuary the surplus population will be housed in the proposed herbivore safari inside NKZP.

Co-operative population management:

A few deer parks and mini zoos in our state one available which also contains some regional endangered fauna viz. chowsingha, mouse deer etc. It is proposed to consider these small captive population of endangered species to be one population and exchange of animals need to be arranged for planned and coordinated breeding programme.

Exchange programme:

During 2007 four hog deer were procured from Lucknow zoo on exchange of a pair of normal coloured tiger. Most of the existing population of lions in NKZP are old and diseased. There are no pure breed of Asiatic lions. Therefore there is urgent need to procure two breedable pairs of Asiatic lions for future conservation breeding. All the single sexed animals need a compatible partner. During September, 2007 Indira Gandhi Park zoo, Rourkela, Orissa exchanged their one male four horned antelope and one female palm civet with one female white peahen, one pair of white ibis and one male gharial of NKZP.

During 2009, one male and one female white tiger were exchanged with Bhopal zoo and one normal coloured wild tigress and a pair of jackal were brought to NKZP. At present there are one male elephants and five female elephants in the zoo. There are one male mouse deer for which breeding is not possible unless two female mouse deer are procured from other zoo. Similarly there is a single sanghai deer for which another two male and two female are to be procured from other zoos. Most of the primates viz. Liontailed macaque, Lilgai langur, Assamese macaque, Potash monkey, Orangutan are single. In order to have a viable breeding population, exchange of animals for compatible companion to be ensured. Among birds, peafowl and white ibis are breeding well. However there is only one painted stork, one spoon bill, one Emu for which breeding not possible. In case of reptiles one female king cobra is required for pairing.

2.(b) Description of the layout plan of the zoo

The layout plan of the zoological park on a scale 1: 3000 depicting contour interval, existing features viz. water bodies, forest patches, natural drainage, water channel, N/S direction, visitor circulation and amenities, site for disposal of carcass, water and electricity supply lines, solid and liquid waste disposal, approach road to the zoo and paths, parking arrangement, gates and barriers, administrative building (zoo office, ticket counter, veterinary hospital) housing colony, rail,

road etc. have been attached herewith as **Annexure-**VII. To appreciate the topography of different areas, particularly for the areas which need intensive development, a contour map at 2 m contour interval has been developed.

The old zoo entrance has been merged with the new entrance plaza and is being designed in modern line with information centre, register guide's counter, 12 booking counter windows, toilet complex, safe drinking water and anti-depredation unit cell. One modern conference hall is on the first floor. CCTV camer5as have been fixed inside this gate complex.

As one enters into the zoo through checking gates one can see officer's colony, store Range Office, OFDC fruit juice stall towards left side and Food court, one small landscape garden, safe drinking water point towards right side. CCTV cameras have been fixed on either side of this ticket checking gates. One observatory has been constructed on left side of checking gate where Range Officers on rotation basis monitor the ticket checking through monitors.

As one further enters into main zoo area, beyond checking gate can find elephant shed, police out-post on the left and 3"D" theatre, interpretation hall, cloak room toward right side. The fountain chhak is the main attraction for visitors where directional signage are being fixed in vantage points indicating various animal enclosures, visitor facilities etc.

As one proceed to the left of fountain chhak through visitor circulation path one would first locate children's park towards east and Nature shop towards west. Then one can proceed to library, new aquarium, new bird enclosures, old bird enclosures through tiled pavement and come to main visitor road. The main visitor bisects the zoological park into two hectares and runs from Gate complex through fountain chhak to reptile park chhak and then upto Gate No.I within the main visitation area.

If one choose to go along the main circular road from children's chhak can see sloth bear and Himalayan black bear enclosure towards right side and zoo hospital on right side. The feed receiving centre, quarantine unit and pangolin conservation breeding centre are located in off exhibit area beyond zoo hospital.

As one moves further on circular road can come across leopard towards left and safe drinking water point, visitor resting area towards right. Beyond this, one can seen white tiger, normal tigers towards left and jackal, hyena, gharial in glass enclosures towards right. Beyond Kanan tiger enclosure one can see lion enclosures towards left and natural forest on right till the nocturnal house square. Beyond this, one can seen tiger enclosure towards left side and new Bison enclosure, lush green lawns with visitor's sit-outs towards right.

As one can reach moated elephant enclosure square on the circular road, the left side road leads towards moated elephant enclosure where one can enjoy captive elephants in sylom back drop with natural vegetation visitors can relax under visitor shed and can see the Katurighasa wetland towards left and egret and herons nesting area towards right.

Again coming back to elephant square one can proceed further on circular road enjoying lush green landscape and zebra on right side and leopard and tiger enclsorues till white tiger safari gate square. From there one moved towards north along the circular road looking at giraffe enclosure on left and zebra enclosure on right till Gate No.I. From gate No.I the visitor can move on main road till reaches the reptile park square. There is a huge dinosaurs statue which is the entry point to the reptile park. From the reptile park one can take the loop by touching toy train, rope way on left side and rhino and hippo enclosure on right side till boat ghat square. The orchidarium and wetland education signages are along the Kanjia lake towards west of boat ghat. The loop road towards east takes the visitor along with the lake to hippo enclosure, cottages, antelope enclosures, water bird aviary, bird enclosures till administrative office square. The OTDC restaurant and Forest Rest House are towards left side and the right side road joins fountain square. Besides this there is a bypass road from nocturnal house square joining reptile park square where one can find nocturnal house, sambar, sanghai, barking deer, small mammal, wild boar towards right and bison, swamp deer enclosure towards left. Similarly another loop road joins from cottage square to OTDC canteen, orangutan, chimpanzee and primate enclosure through spotted deer, nilgai, cassowary, emu and squirrel monkey enclosure where one needs at fountain square. One can catch safari buses near the reptile park square can go to white tiger and lion safari. Near safari bus counter there is a small loop joining gharial pool, security office,

mugger pool joining the main road near ladies toilet complex. There are drinking water points toilets and sit-outs all along the visitor circulation path. Well laid tiled pavements, stand off barriers giving ethnomic look are features of the visitor circulation path in most area of the park.

Zoo kitchen, feed storage godown, feed receiving centre, isolation unit, quarantine unit, zoo hospital, workshop etc. have been located among from the visitor area. So far services roads have not been formed exclusively for zoo management except in lion safari feeding cubicle.

The layout map of Nandankanan Zoological Park (enclosed) has been prepared with 1:2500 scale with 2 m contour interval depicting all the enclosures, administrative building (zoo office, ticket counter, entrance complex, zoo hospital etc.) roads, staff colony, parking zone, visitor circulation and amenities, water bodies, roads, fodder farm safaris etc.

Existing Animal enclosures

There are 101 enclosures and cages housing 118 species of mammals, birds and reptiles.

(A) Enclosures to be modified

Four horned antelope, Nilgai, Blackbuck, Spotted deer, Hog deer, Emu, Cassowary, Assamese macaque, Bonnet monkey, Rhesus monkey, Potas monkey, Encl. No. 18(old tiger enclosure), quarantine, isolation unit, water bird aviary, white tiger safari feeding cubicle, Sambar, Barking deer, Sanghai, Mouse deer need modifications.

(B) Enclosures that need to be redone after demolishing the old structure

Hamadryas baboon, Common peafowl, Black swan, Mandarin duck, Saurus crane, Sambar, Small mammal, Reptile Park, Bird enclosure No. 11 housing Koel to Alexandrine parakeet, leopard enclosure No. 19, Encl. No. 23 (Jackal), Enclosure No. 24 (old Jaguar enclosure), squirrel monkey, mithun enclosure.

(C) Improvement of existing enclosures:

A number of enclosures which were constructed much earlier are very old and do not confirm to the modern concept of zoo design or they do not meet the biological need of the species housed in them. Some of them shall be completely demolished or few others shall be modified to meet the specifications recommended in the Recognition of Zoo Rules, 1992. These rules and further

guidelines of CZA shall be scrupulously followed while designing new enclosures or modifying the existing enclosures.

The boundary fence of white tiger safari which was completely damaged due to super clone in October, 1999 has been restored. Top priority need be given for reconstruction of the suitable cave type structure at the entrance to this safari. A buffer should be provided for this as recommended in the protocol for Safaris by CZA. The weed clearance inside the Safari should be ensured annually for better appreciation of visitors and to enhance sighting. One more water body with furniture is to be created near the white tiger safari feeding cubicles. The removal of weeds on either side of the chain link fence is to be cleaned once in three months for proper checking. The construction of secondary wall of defence around lion & tiger safaris is to be completed as early as possible in phased manner. Already about 550 mtr. of secondary laterite wall has been erected during 2006.

(D) Proposed new enclosures

Birds- Indian pied Hornbill, Great Indian Hornbill, White backed vulture, Pariah kite etc.

Mammals- Giant squirrel, Flying squirrel, Golden langur, Indian fox, Wolf, Wild dog, Hoolock gibbon, Smooth Indian otter, Fishing cat, Lemur, Kangaroo, Wallaby, Marmoset, Yellow baboon.

Herbivore safari

Reptiles- Green iguana

Amphibian Park

Butterfly Park

Construction of new enclosures:

Since certain species are highly specific to their life style with respect to their food and shelter, the housing in a few cases shall need more space for their naturalistic display as well as to meet their behavioral needs. Some new enclosures to be added following the appropriate enclosure design with appropriate environmenalt enrichment in order to make the zoo more interesting and attractive. New enclosure for Giraffe has already been constructed near the existing Zebra enclosure during 2008.

The cage type monkey house near the moated primate enclosures on the main road neither meets the biological requirements of the species nor is aesthetically appealing. This needs to be demolished and suitably designed island type moated enclosures should be constructed.

New exhibits for canids like wolf and jackal should be constructed next to existing hyena enclosure. The old monkey enclosure which is now housing both water birds and terrestrial birds temporarily need be demolished and new enclosure to be constructed for use by land birds only.

New pheasant enclosures need to be constructed by demolishing the old bird enclosure No. 11.

Hornbill enclosure- Hornbills are very attractive birds and housing a few of them would enhance the exhibit value. The enclosure is to be made very spacious with respect to height and width with a natural ficus tree enclosing inside. Proper enrichment are to be provided to enable the birds to show their natural behaviour.

Hollock Gibbon enclosure- This is a very attractive animal and is a crowd puller. One new Hollock Gibbon enclosure need to be constructed with island type design near existing Nilgiri langur enclosure. This can be obtained from Tripura and Assam Zoo on exchange programme.

Marsupial enclosure- Exotic animals viz. Kangaroo and Wallaby can be procured. They can reproduce very fast and are very attractive animals. Appropriate moated type and spacious enclosure mimicking these natural habitat can be constructed near existing spotted deer enclosure.

Enclosure for flightless birds- There are flightless birds viz. Ostritch, Emu, Cassowary, Kiwi available in Australia. It is proposed to have Ostrich enclosure close to existing Cassowary and Emu enclosure.

Amphibian park- Considering the present crisis of Amphibians, an amphibian exhibit would be established near the reptile park. Nandankanan is rich in interesting amphibian species diversity. The basic objective of the exhibit would be to make the visitors

aware about what is an amphibian and how amphibians are an integral part of our ecosystem and about its conservation need and also about the problem of Amphibian extinction.

Aquarium- A state-of-art zoo aquarium has already been set up in collaboration with Center for Environment Education with well researched education materials during February, 2008. The objective of the aquarium is to educate the visitors about the threats to our aquatic ecosystem and about their conservation needs. At present there are 14 aquaria out of which four are marine aquaria. The existing aquarium needs to be outsourced for better visitor management. In future four more aquaria can be added in the central portion of the hall. Provision of air-conditioning is required for management of aquaria during pinch summer period.

Herbivore safari- An area of 34 ha has been earmarked for construction of herbivore safari to accommodate surplus animals of the zoo. It is proposed to maintain composite species viz. sambar, nilgai, spotted deer, barking deer etc.

2. (c) Proposal to address the inadequacies and shortcoming identified in the appraisal report (as appraised in Part-1, 2 (a)

2.(c) (i) Animal section

The animal enclosures were assessed and the following modification are to carried out. Care has been taken to provide adequate space to all the species to be exhibited in new enclosures and also those which are to be modified. However, care has been given to consolidate the present situation then to expand in form of too many new exhibits. Further adequate attention has been given to ensure that the areas already croweded with exhibits will not be further congested.

Enclosure No. 1 to 10- Bird enclosures

The existing chainlinkmesh has worn out and need to be replaced with new half inch chainlinkmesh and must be pointed with black paint to enhance visibility. More enrichment in shape of perching using natural tree branches to be done. Breeding boxes to be provided and feeding platform to be provided with ant proof arrangement. The enclosures to be made rat and snake proof. Glass wares to be provided for serving drinking water and food instead of centered troughs to maintain better hygiene. More ventilation to be provided as per requirement. Shade to be provided during summer with straw thatching.

Enclosure No. 11- Bird enclosure

The enclosure need to be demolished completely and new enclosures to be constructed as the existing enclosure is quite old and out dated. Now pheasant enclosure, enclosure for koel, pariha kite, scavenger vulture to be constructed in and around the existing enclosure.

Enclosure No. 12- Cinereous vulture enclosure

The visitors need to be attended to view from one side only. Shade to be provided during summer season with straw thatching. The coir rope guarding of iron perches to be made a fresh in every year.

Enclosure No. 13- New bird enclosure- Macaw enclosure

The green painted chainlinkmesh to be replaced with black painting for better visibility. Adequate shed is to be provided.

Enclosure No. 14- Hyena enclosure

At present it is lying vacant. The size of the cave to be increased and shade to be provided in one side.

Enclosure No. 15- Himalayan Black bear

Shade to be provided in one side. The cave type platform to be modified giving an ethical look. Drainage system for moat water clearance to be provided.

Enclosure No. 16- Sloth bear enclosure

Drainage system for cleaning moat water to be restored. Shade to be provided. Wooden enrichment structures to be provided. Concreted structure from exhibit area to be replaced by wooden structure which would give ethnic look. Painting of enclosure, squeeze cage, white washing to feeding cubicle to be done annually. The inbuilt cemented trough for feeding and drinking to be replaced by new structure. Flooring to be done a fresh. The ventilation of the feeding cubicle to be enhanced provision of electricity may be taken up.

Enclosure No. 17- Already demolished (old Manipuri deer enclosure)

Enclosure No. 18- Old tiger enclosure

This enclosure need to be modified by providing new chainlinkmesh with concrete base upto one foot height. Chainlinkmesh to be painted with black paint. The water tank, feeding cubicle sliding doors and window to be replaced by new one. One squeeze cage to be provided as the enclosure is mostly used for quarantine purpose of newly arrived animals including leopard and tigers also.

Quarantine unit

The cells in quarantine units require complete renovation. There is need to have windows in each cell for proper ventilation. The flooring, inbuilt drinking water trough and feeding troughs need to be reconstructed. The existing chainlinkmesh with angle iron, sliding doors etc. need to be reinforced and replaced completely by new chainlinkmesh with proper black paintings. The water storage tank need to be reconstructed by increasing the storage capacity. The drainage channels to be reconstructed. The quarantine entrance gate to be renovated and strengthened to prevent escape of animals. In one kraal water tank to be constructed to quarantine tigers if needed.

Enclosure No. 19- Leopard enclosure

This enclosure need to be completely demolished and a new enclosure for leopards to be reconstructed in modern line with proper enrichment facilities. Proper stand off barrier need to be constructed.

Enclosure No. 20- Tiger enclosure

More enrichment facilities to be provided. The chainlinkmesh fence need to be painted annually with black colour to enhance visibility.

Enclosure No. 21- Tiger enclosure

The old chainlinkmesh fence to be replaced by new ones with one feet concrete base. The chainlinkmesh to be painted black to enhance visibility. The feeding cubicles to be provided with better ventilation. Old sliding doors, gates and windows to be replaced by new ones. Flooring, inbuilt squeeze cage, drinking troughs to be renovated.

Enclosure No. 22- Already demolished (old tiger enclosure)

Enclosure No. 23- Jackal enclosure

The whole structure need to be demolished and a new jackal enclosure to be constructed.

Enclosure No. 24- Old Jaguar enclosure

The whole structure need to be demolished and a new Jaguar enclosure to be constructed with enrichment, stand off barrier, pavements etc.

Enclosure No. 25 & 26- Hyena enclosure

The existing enclosure required little renovation/modification. Appropriate cave, squeeze cage to be need to be modified.

Enclosure No. 27- Gharial glass house

The exhibit are to be filled with sand. The glass need to be changed. One water filter to be fixed before inlet point for maintaining quality water. The tunnel floor, stand off barrier need to be renovated. The outlet of gharial glass to be redesigned.

Enclosure No. 28- Tiger enclosure/Kanan enclosure

The chainlinkmesh to be replaced and new chainlinkmesh with black paints need to be fixed upon one feet high concrete base. The back kraal to be renovated completely with similar design. The sliding door floor, floor, embedded water trough to be renovated.

Enclosure No. 29- Lion enclosure

The tall wall around the lion enclosure need to be strengthened as it has developed some crakes. The floor, sliding door to be renovated. The old chainlinkmesh in kraal to be replaced by new ones with black painting.

Enclosure No. 30- Tiger enclosure

The old chainlinkmesh to be replaced by new ones. The new chainlinkmesh to be fixed over one foot high cement concrete for lasting long. Black painting to be done on chainlinkmesh to enhance visibility. The flooring, sliding door and feeding cubicle need to be renovated.

Enclosure No. 31- Tiger enclosure

The roof of feeding cubicle to be demolished and new RCC roof need to be provided as the existing roof is unsafe for tigers. The old chainlinkmesh in 31/A and kraal of 33/C & D to be replaced by new ones. The new chainlinkmesh in 33/A to be fixed on one foot high concrete base. All gharials to be painted black to enhance visibility and durability. The sliding door and flooring need to be renovated completely.

Enclosure No. 32- Tiger enclosure

The old chainlinkmesh to be replaced by new ones and one foot concrete base and painted black to enhance durability and visibility. The moat wall in 32/A towards visitor side has developed

cracks for which the same to be constructed a fresh. The sliding door, flooring etc. to be renovated.

Enclosure No. 33- Tiger enclosure

The old rusted chainlinkmesh need to be replaced by new ones on one foot high concrete base to enhance durability. Further black paints to be given on new chainlinkmesh to enhance visibility and durability. The sliding door and flooring to be renovated.

White tiger safari

This requires renovations. One side of kraal needs to be demolished and new chainlinkmesh to be fixed over 2 ft. concrete wall. The sliding doors, flooring, inbuilt, water trough to be constructed a fresh. Provision of electricity to be done. Provision of squeeze cages to be made in other end of feeding cubicle. Painting of chainlinkmesh, squeeze cages to be done.

Enclosure No. 34- Zebra enclosure

The existing old chainlinkmesh to be replaced by new ones and painted black for durability and enhancing visibility. The chainlinkmesh to be fixed on one foot high concrete wall. One permanent shade with slopy roof to be made. Isolation unit to be constructed after demolishing the existing feeding cubicle. Water troughs, feeding troughs to be constructed a fresh.

Enclosure No. 35- Nocturnal House

The existing nocturnal house needs complete renovation. There is need for extension of the nocturnal house to accommodate more variety of nocturnal animal species. This is to be constructed with modern design with proper illumination, ventilation, breeding enclosure etc. The existing nocturnal house to be provided with proper ventilation and illuminate. The back kraal to be completely demolished and new kraal to be constructed. The existing Chiroptera spp. naturally available inside nocturnal house is to be preserved.

Enclosure No. 36/A- Sambar enclosure

The existing sambar enclosure to be demolished and moated type enclosure to be constructed with isolation and restraint facility. Wallows to be provided with shady trees. Permanent shed with ethnic look (Thatched) type to be constructed.

Enclosure No. 36/B- Sanghai enclosure

The existing enclosure to be modified with moated type enclosure design with isolation unit. The water tank, feeding platform to be reconstructed. Permanent shade with ethnic look to be constructed.

Enclosure No. 36/C- Barking deer enclosure

The existing enclosure to be modified with moated type design. Isolation units, separate kraals to be constructed for treatment and segregating aggressive animals. Stony small caves to be provided for seclusion and giving birth.

Enclosure No. 37 (A to K)- Small mammal enclosures

This is to be completely demolished and new small mammal enclosure to be constructed with natural substrate, water points, plants etc.

Enclosure No.37/L – Wild boar enclosure

It would be modified with natural wallows, isolation unit, pavement and stand off barrier.

Enclosure No. 38– Swamp deer enclosure

The enclosure need to be modified with change of topography towards north and providing natural swamps. One isolation unit, restraint facility to be provided. The existing moat to be redesigned and chainlinkmesh to be removed for a naturalistic look taking into consideration the jumping habit of the deer.

Enclosure No. 40– Gharial pool

The existing gharial pool is to be provided with better aeration facilities. Arrangement for removal of silt to be made periodically. The inlet water to be allowed to fall from a greater height so as to enhance the oxygen level in water.

Enclosure No.41 – Mugger pool

Sand bed to be provided for basking.

Enclosure No. 44 to 51– Reptile park

The existing facility for snakes, crocodiles, chameleon, star tortoise to be demolished and modern type housing facility with enrichment to be constructed. The existing facility is neither sound from meeting the biological needs of the reptiles nor aesthetically good looking. Electricity and water supply system to be completely revamped.

Enclosure No. 61– Rhino enclosure

The existing facility is good but the main feeding area cum exhibit area to be modified into a moated type design with wallows.

Enclosure No.62 & 63 – Hippo enclosure

These are good enclosures but the isolation unit to be modified. Aerators to be provided to enhance the oxygen level. Pollution level of the existing water to be reduced by suitable mechanisms.

Enclosure No. 64– Chowsingha enclosure

The boundary wall towards south to be strengthened. The isolation unit, permanent shade, water tank to be provided.

Enclosure No. 65 to 67– Blackbuck enclosure, Nilgai enclosure, Hog deer enclosure

All these enclosure, the chainlinkmesh to be fixed over one feet height chainlink fence painted with black paint. Permanent shed with ethnic structures, water trough etc. to be provided.

Water bird aviary(Encl. No. 72)

This needs immediate painting with black paint to enhance durability and visibility. The iron ropes need tightening. The aviary water need aerators to enhance oxygen level. More perching, nesting area with stones needs to be provided.

The enclosure housing Mandarin duck, Saurus crane, peafowl need to be completely demolished and new enclosures in modern line to be constructed.

Enclosure No. 74– Squirrel monkey

This need to be demolished completely and a new enclosure to be constructed taking its tropical rain forest requirements.

Enclosure No. 80– Brahmini kites

It needs no renovation

Enclosure No. 81 to 84- Bird enclosures

The existing chainlinks to be painted black to enhance durability and visibility.

Enclosure No. 70- Cassoary

The existing chainlinks to be painted black to enhance durability and visibility.

Enclosure No. 73- Emu

The existing chainlinks to be painted black to enhance durability and visibility.

Enclosure No. 85 to 89- Birds enclosure in children's park

The chainlink to be replaced by removed and painted black to enhance visibility and durability. Feeding troughs and water troughs made of glass to be provided to reduce bacterial growth. New nest boxes to be provided.

Enclosure No. 94 – Moated elephant enclosure

One water storage structure to be constructed for storing more than 2000 litr. Water. The existing RCC roof is inadequate to give protection from hot winds and direct light during summer. One permanent shade to be provided towards southern aspect to protest the elephants from hot summer winds. The existing sliding gate to be replaced with moated typed arrangement with wooden/steel platform to prevent entry or escape of elephants. The existing bathing pond for elephants to be renovated.

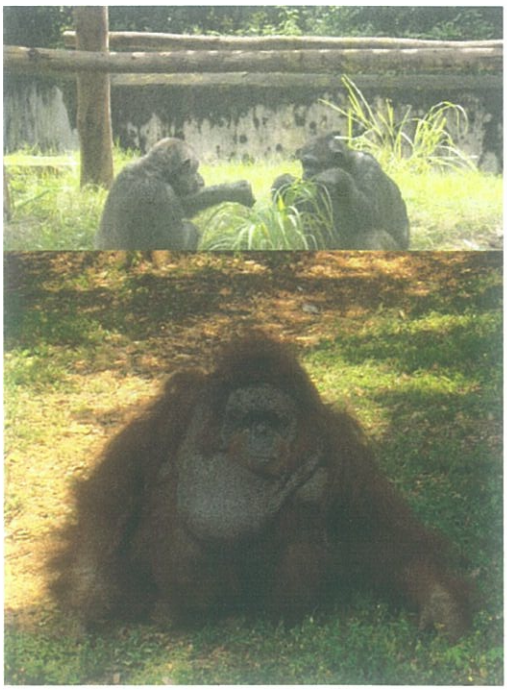
Lion safari feeding cubicle

The existing chainlinks in and around kraal to be painted with black paint. Water troughs to be renovated. Permanent shade to be provided towards southern aspect. The sliding doors, windows of some unrepaired. Cells to be replaced with new ones. Electricity and water supply to be augmented in a better way. The flooring inside feeding cubicle, water trough, feeding platform to be reconstructed. The corridor floor to be reconstructed.

Chimpanzee enclosure No. 60/A

The isolation unit is to be constructed. One permanent shed with RCC roof and ethnic look to be constructed to enhance visitor appreciation as during mid-day they retreat into feeding cubicle for 4 hours. More enrichment materials for climbing and playing are to be provided.

Orangutan enclosure No. 60/B



There is urgent need for construction of a second line of protection to prevent escape of orangutan. The existing secondary wall along corridor is to be fitted with thick iron grills and gates for the purpose. One permanent shade with ethnic look to be constructed inside exhibit area so that the visitors would be able to see orangutan more time as it frequently retreats into feeding cubicle for shade.

Spotted deer enclosure No. 68

Two permanent shades are to be constructed with ethnic look. The existing chainlink fence is to be replaced with new chainlink on one foot high laterite stone base. Arrangements are to be done for segregating male and female by providing a suitable gate. Restraint and treatment facility are to be created. Gabions with bricks to be provided around ficus plants to prevent antler rubbing while ultimately kill the plants.

2. (c) (ii) Veterinary Section:

The present Veterinary Hospital has a drug dispensary room, a laboratory, X-ray unit, operation theatre, physiotherapy unit, isolation ward and quarantine within its campus.. Some additional amenities need be provided to make the hospital responsive to all the immediate needs of animal health care. Following equipments need to be procured for the Zoo Hospital for better management of health care

1. Digital Camera/Handycam
2. Egg Incubator
3. Metal detector
4. Digital thermometer
5. Computer with printer
6. Trinocular Microscope
7. Laser Thermometer
8. Cryo can
9. Tranquilizing Equipment set
10. Surgical kit/Examination Table
11. Portable X-ray machine
12. Remi centrifuge
13. Hot air oven
14. P.H. Meter Digital
15. Haemoglotinometer

16. Electronic weighing machine
17. Robust mechanical weighing machine.
18. Air cooler

(a) Construction of new zoo hospital building- The existing zoo hospital building was constructed in 1983. This building is having low plinth for which rain water enters in to the building. Further there are insufficient rooms to accommodate zoo vets and to run the pathological laboratory, storing medicines etc. The roof is leaking and the electricity wiring is out-dated. Therefore it is proposed to have a new zoo hospital building. The existing bacteriological laboratory need to be air conditioned.

(b) Quarantine Ward: This has been badly damaged by the cyclone and this needs to be modernized to house all types of animals. Suitable restraining facilities for examination and treatment of animals are to be provided. The existing quarantine unit need to be upgraded and the chainlinkmesh to be replaced by square bars to prevent injury and escape. The floors need to be tiled and windows with square bars to be provided for proper ventilation. The sewerage system and water storage structure need to be upgraded.

(c) Disposal of carcasses: At present the carcasses are disposed off in the wood based incinerator, one near lion safari feeding cubicle and another attached to the new slaughter house. These two incinerators were constructed during 2007. Proper boundary wall, tiled approach road to be provided for the wood based incinerator constructed near lion safari feeding cubicles.

(d) Post mortem room: The existing PME hall near zoo hospital has been abandoned and construction of new post-mortem hall is in progress. It would be provided with glazed tiles upto 5 ft. of wall and floors. Permanent electricity and water storage facility with quality basin and sewerage system would be provided. It is proposed to construct a boundary wall to prevent entry of tresspassers into the post-mortem room and wood-based incinerator complex. It is contemplated to provide a better approach road to the new complex.

(e) Isolation unit: The existing isolation unit has been renovated by providing new asbestos roof, tile flooring, new electricity and water connection etc. However, it needs further improvement by providing larger squeeze caging facility for treatment and post-care operation of large carnivores. Similarly facility for holding birds, reptiles and small mammals need to be developed. An air conditioned cubicle inside the isolation ward need to be provided for treatment of animals suffering from summer stress.

(f) Assistance from Specialists: Health Committee of the Orissa Veterinary College visits the zoo as and when required and give valuable advice to the zoo veterinarians for treating the sick animals properly. This practice need to be formalized with a Government order in consultation with the University and it need to be continued. A Technical Committee of expert veterinarians and zoo officials to oversee and advise on technical and other matters has been formed by the Government of Orissa in the year 2000. The Committee meets periodically to review and advice the zoo authorities for betterment management of the zoo.

(g) Education and Training: The Orissa Veterinary College has also used the facilities in the park for training their Post Graduate students as internees in management of animals in captivity and their health care. Even the undergraduates need more exposure to wild animal treatment, health care management, tranquilization etc.

(h) Organizational set up: At present the zoo has one Senior Veterinary Officer and one Veterinary Assistant Surgeon who are assisted by one leave reserve VAS in the cadre of the Animal Resources Department of the State. There are three posts of Livestock Inspectors and only one is available. The zoo vets are supported by one regular Class-IV staff and three EPF workers. There is a need for a Laboratory Assistant, Technician to handle modern equipments.

(i) Reference Library: Though the zoo has a fairly good library, the veterinary section need to have a small reference library with latest publications containing papers on treatment of different diseases.

(j) Two computers with printers and two laptops with internet facilities need to be provided to the zoo hospital for storing of valuable data of zoo and for day to day office work. Three VHF handsets are being provided to zoo vets for better communication. Recently one Tata Indicom phone has also been provided to him.

2. (c) (iii) Store & Feed supply section:

The store section mainly deals with procurement and supply of feed to the animals. Presently the Store Range Office is functioning in one of the residential buildings of the colony. One dry feed

storage godown is also furnished to keep the dry feed items in a better condition. Required number of storage boxes for storage are being provided. Weighing Machines are used in the Feed Receiving Centre for weighment of feed and other items. Two nos. of Fly Catchers are provided to reduce flies in the vicinity. One new modern feed receiving centre has been constructed in between parking area and existing feed receiving centre to avoid disturbance and to restrict the movement of feed contractors.

For hygienic feed distribution, sufficient feed containers are to be purchased with two nos. of Feed Transport Trolley. The existing Trollies and containers are old and require replacement. It is proposed to purchase one dedicated feed transportation vehicle for smooth distribution of feed to various enclosures.

One new slaughter house has been made operational with effect from 20.01.2007 which is first of its kind in Indian zoos. One wood based incinerator, waste disposal system, water storage and supply system and other facilities have been provided. This is also ensuring proper ante-mortem and post-mortem of the slaughter animals by zoo vets.

A fodder farm extending over 33 Ac. was established in 1997 towards western boundary of the zoo. This has helped in achieving self-sufficiency in fodder supply on a sustained basis for the captive herbivores of the zoo various type of cereal, legume and tree fodder is being cultivated in the captive fodder farm viz. NB-21, Bajra, Maize, Cowpea, Paragrass, Common grass, Stylo grass, Oat, Ricebean, Berseem, Lucerne etc. Banana culm and bamboo are also being harvested. For last two years planting of ficus trees have been taken up to meet the demands of elephants, deer in future. On an average more than 20 quintal of green and palatable fodder is being harvested every day.

2.(c) (iv) Sanitation section

For cleaning feeding cubicle etc. jet sprayer machine need to be purchased. It is proposed to outsource the sanitation work outside the enclosures viz. maintenance of toilets, drinking water points, sweeping of main roads, visitors' path, cleaning of lawns etc.

2.(c) (v) Maintenance section

The workshop and maintenance section is looked after by Range Officer, Sanctuary Management. After getting complaints from various enclosures, the maintenance work is taken up on a priority basis. However due to inherent difficulty in maintenance it is contemplated to give Annual Maintenance Contract (AMC) to some private contractor for certain maintenance items.

The existing workshop and yard is in a dilapidated condition. There is urgent need to have a new workshop and maintenance building with good storage yard with boundary wall to prevent theft and pilferage.

2. (c) (vi) Security section:

It is of paramount importance to keep the zoo animals, visitors, zoo staff and their families, zoo property both movable and immovable safe and secure to make the zoo function properly. Nandankanan zoo spreads over vast stretch of forests, water body, undulating terrain and is prone to security hazards, as compound wall all round the park is still incomplete and the water body which is exposed to outside can be easily crossed by miscreants and cattle. A public thoroughfare road also passes through the heart of the zoo premises. These problems need be addressed on priority basis besides beefing up of the security arrangement. The measures need to be taken in near future are:

i) Completion of the compound wall is urgently needed especially in the eastern side.

ii) Provision of an alternate road between Raghunathpur and Daruthenga villages on the south of the zoo.

iii) More VHF hand sets should be procured and be made available to the security personnel to muster additional man power in the event of any exigencies.

iv) Mock drills should be carried out for preparing the security as well as other zoo staff for meeting any security related threat and more personnel to be deployed.

v) All staff colonies need to be relocated outside the zoo boundary preferably behind Nandankanan High School. The staff together with their vehicles are creating serious disturbance to zoo animals.

vi)Warning systems need to be strengthened using modern technology. It is proposed to install e-security system by fixing infrared sensitive CCTV cameras in vulnerable points inside NKZP. This would enhance our capability to prevent theft of animals from vulnerable enclosures.

vii) A dedicated vehicle need to be available to the Security Range officer for night patrolling so that he can go round the park at night to check the activities of patrolling staff.

2. (c) (vii) Water supply section:

There is need for construction of three large overhead tanks for meeting the water requirement in carnivore enclosures, deer and antelope enclosures and zoo hospital, quarantine, isolation unit, feed receiving centre complex. It is proposed to have a dedicated water supply system for mugger and gharial pool. Similarly one dedicated drinking water pipeline to be laid

out by upgrading the existing chlorination water supply system. Two deep bore well to be dug and fitted with the supply system and pumps to augmentation water supply system in case of exigencies. At present only one electrician is available who happens to be a EPF staff. Therefore engaging one electricians and one plumber for maintaining electricity and water supply system need to be taken up in future.

It is proposed to upgrade the existing **chlorination plant** set up near boat ghat with activated carbon system. Further it is proposed to set up another new chlorination plant near workshop area with activated carbon system. This new chlorination plant would be helpful to provide safe drinking water to visitors in gate complex area, gate No.II, nature shop, bear enclosure where drinking water points are available. Further this new chlorination plant would provide drinking water to staff colonies near gate No.II, zoo hospital, quarantine, new feed receiving centre and pangolin conservation breeding centre.

2. (c) (viii) Electricity supply section:

The existing two no. of 100 KVA transformers are not able to take the electricity load for which there is frequent power failure. There is low voltage problem and there is no uninterrupted power supply for smooth functioning of different electrical equipment. The upgradation of 11 KV line into 33 KV line is about to be completed. Further two 250 KVA transformers have been installed which would be able to cater the future electricity need of the park. Most of the electricity supply line would be underground cable and wherever needed AB cables would be provided. This is needed for safety of the visitors as well as captive animals of the zoo. Nandankanan is at present comes under rural area of CESCO electricity delivery system for which there is frequent power cuts.

Already two eco-gens of 15 KVA and 25 KVA have been installed in Gate complex and Aquarium for interrupted power supply. However eco-gens are also needed for Administrative building, FRH, zoo hospital, Nocturnal House. The existing 200 KVA Gen-set is to be augmented with cables and other electrical fittings for managing uninterrupted electricity supply in case of power failure. In addition to these facilities, solar lights have been provided in important places of the zoological park.

2. (c) (ix) Disposal of solid waste & liquid waste- sewerage & drainage

Disposal of waste- Disposal of leftover bones from carnivore enclosures is being done by dumping the same inside four number of bone pits. The bone contractor takes away the bones from the bone pits at regular interval. It is proposed to close down the existing bone pits and to

construct new one towards South-West corner of the zoo. Further, one dedicated vehicle to be procured for transportation of left-over bones from carnivore enclosures to the afore mentioned new bonepit, from where the bone contractor would lift the left-over bones at regular intervals. The biodegradable waste materials are being recycled. Composting is being done in fodder farm area by utilizing the leftover fodder of herbivores. The liquid waste from enclosures is being drained into pits which are situated inside the natural vegetation of respective enclosures. The use of polythene and polypacks have been banned inside the park and the same is being screened near the entry checking gate. It is proposed to establish one sewerage treatment plant in the zoo for treatment so that the treated water can be used in the lawns and gardens.

The northern facing aspect of the zoo near Kanjia lake is the area of water logging and submergence particularly during monsoon. The road from children park to zoo hospital become water logged in monsoon for which proper drainage system need to be developed by draining water to Katurighasa nala area beyond abandoned incinerator. Large discharge of rain water from carnivore enclosures i.e. from Jaguar chhak to leopard enclosure No. 19 enter into zoo hospital. Although during 2007 some temporary drainage channels have been provided along quarantine towards PME hall yet there is need for construction permanent drainage channels. Similarly the temporary drainage channel for draining out flood water from zebra to abandoned gharial hatchling pool and gharial pool lawn to nocturnal house need to be upgraded. With the expansion settlement in and around eastern boundary of the park, the natural drainage channel of Kanjia lake has been partly blocked. Unless the natural drainage channels are kept free, then there might be severe flooding in Kanjia lake in near future, there by inundating large areas of the zoo. The natural drainage system on the upstream area and downstream area of Kanjia lake need to be protected by removing blockage wherever necessary.

2. (c) (x) Visitor amenities

Nandankanan being a large zoo with vast areas to be covered, there should be adequate visitor amenities so as to make the visit pleasant, less tiring and memorable. The following amenities are proposed to be developed.

(i) Safari vehicles- At present both the safaris have been outsourced. Although three battery operated vehicles made by BHEL are available in the zoo, yet those are not being made operational on a sustained basis due to non availability proper maintenance and services. Pollution and noise free safari vehicles run by CNG or battery would be given preference in future. In order to caters the demand of visitors, AC safari vehicles can also be allowed in future.

There is a proposal to enhance sighting of white tigers and lions in safaris by creation of medows and water bodies.

(ii) Toy Train- Recently the toy train has been privatized which has reduced enormous botheration from zoo management. The present diesel engine can be converted to LPG or battery in near future to make it environmental friendly. In order to break them monitoring of the existing toy train trip, it is proposed to take up landscaping along the toy train and Kanjia lake and to enhance the lake view in a better way. Similarly setting up small aviaries, interesting feature as dinossaur made up of fibre glass or cement concrete, gardens, planting of ornamental flowering trees would make the trip memorable for children. The existing platform and toy train can be further upgraded with better quality sit-outs, modern toilets, landscaping, lawn & gardens.

(iii) Visitors' cab- In order to enable old people, disable people, children and other interested visitors to go around the park, two battery operated ten seater vehicle were being pressesed into service by OREDA (Orissa Renewable Energy Development Agency). However there is huge demand for more number of vehicles for a comfortable view of various enclosures. The facility can also be outsourced by engaging private parties on lease/tender basis. Nandankanan being an large zoo, visitors feel difficulty to cover within a short time. In future more such pollution and noiseless cabs can be engaged to cater to need of the visitors.

(iv) Children's Park- The existing children's park need to be upgraded in collaboration with tourism department with latest package of children's amusement equipments including animal models. Further proper landscaping and beautifications need to be taken up. One drinking water point, toilet, adequate number of sitting benches need to be constructed. The existing bird enclosures need to be renovated with proper colouring, tile flooring providing etc.

(v) Boating facility- Recently the boating facility in Kanjia lake has been privatized. This has enhanced the revenue to a substantial level besides reducing the management problems arising out of old and unsafe boats. However there is need for renovating the existing drinking water facility. A few "Sikara" type boats can be introduced for visitors to enjoy the scenic beauty of Kanjia lake. Although life jackets are being made available to visitors yet there is need for their proper upkeep and enforcement for use by visitors. The boating area needs proper landscaping towards elephant bathing ghat with adequate number of sitouts for resting.

(vi) Kiosks/Canteen- At present OTDC is running one restaurant and one canteen on payment of minimal rent and royalty. It is proposed to run kiosk and food court by some branded agency

which will cater the need of the visitors. There is great scope for setting up kiosks near white tiger safari square, boat ghat and parking area.

(vii) Toilet complex- The existing toilet complex near Reptile Park, library and security office are outdated. Modern toilet complex are proposed to be constructed near Boat ghat, new aquarium, reptile park, nocturnal house, parking complex etc. Pay toilets catering needs of various classes of visitors to be constructed and to be managed by private parties. The existing two toilets meant for physically challenged persons need to be upgraded

(viii) Visitor shelters- At present there are visitors shelters near FRH, water bird aviary, brahmini kite, bear, jaguar, nocturnal house, tiger encl. 33, white tiger safari gate, Gate No.I, in between Gate No.I and Reptile Park square and cottage No.IV. However more numbers of shelters are needed to protect the visitors from sun and rain. New shelters need to be constructed near new leopard enclosure, boat ghat, beyond orchidarium, spotted deer enclosure, near library and children's park. The existing visitor's shelters are to be provided with RCC roof and renovated with ceramic flooring, putting granites slabs on sitting benches. All structures constructed with architectural designs with good aesthetic look and merging colours. All surrounding area of shelters need to be landscaped.

(ix) Wheel chairs & perambulators- At present there are six wheel chairs and a damaged perambulators available for physically challenged persons and small kids respectively. Ramps have been provided for the smooth movement of wheel chairs in many enclosures. However ten new wheel chairs and two new perambulators need to be purchased to cater the demand of the visitors.

(x) Aquaguards and water coolers- At present aquaguards and water coolers are available near boat ghat, toy train, canteen, nature shop and Gate complex areas. However heavy duty water cooler and aquaguards need to be installed in the existing drinking water points to cater the demand of the visitors during summer. Service providers on Annual Maintenance Contract need to be engaged for smooth functioning of all safe drinking water points. New drinking water facilities need to be set up near giraffe enclosure, tiger enclosure No. 32, ropeway station, aquarium, security office, moated elephant enclosures, children's park, water bird aviary, parking areas.

(xi) Parking complex- The existing parking area near Gate complex need to be enlarged to make its capacity almost double to accommodate one thousand four wheelers and one thousand two wheelers during pick tourist season. All amenities of a modern parking complex to be

provided with landscaping, one way entry, toilet complex, drinking water facility, visitor shelters, driver retiring room, light and announce system etc. to be developed.

(xii) Visitor path and internal roads- All existing visitor paths need to be paved with tiles. Wherever, there is no proper visitor path, the same need to be completed soon. Adequate stand off barriers need to be provided and ornamental hedge plantation to be taken up. The interal roads need to be black topped or concretized according to situation. Side drains to be provided and proper camber to be maintained while aligning roads.

There is urgent need for widening of road from zoo hospital to zebra enclosure, nuctornal house to reptile park. The road from boat ghat to cottage No.IV over 220 mtr needs to be concretize and widen up to 4.5 mtr as the existing morrum metal road is submerged during rainy season. Further the road from cottage No.IV to water bird aviary needs to be widened. The road from reptile park to boat ghat need to be relaid with proper camber and drainage facilities to avoid submergence during rainy season. Widening of road would help better visitor circulation during rush hours.

(xiii) Visitor centre/Interpretation centre- It is proposed to establish one visitor centre near the gate where the visitors will get first-hand informations regarding the zoo. There will be a small auditorium where the visitors will be shown small film on history, uniqueness of the zoo and interesting exhibits of the zoo.

2. (c) (xi) Lawns & gardens- landscape section:

Nandankanan Zoological Park is located in a sylvan setting with a lot of natural vegetation exists within the premises. The vegetation has been kept intact at many places. This has reduced the requirement of more of artificial gardens or lawns. But, still some formal or informal gardens do have their aesthetic appeal to visitors and zoo inmates also. New landscape gardens to be developed along the Kanjia lake from Orchidarium to colony No.9. Landscaping near gate complex to parking area is needed to enhance beauty of the entrance point. Road side landscaping is needed along carnivore enclosures, reptile park square to nocturnal house square, sambar chhak to reptile park.

Garden:

Formal lawn and garden have been created close to the main gate of the park, near orchidarium, administrative building, FRH, Library, Reptile park etc. The lake side on the north of the present ungulate enclosures can be developed properly with proper landscaping and planting for a very special appeal for the visitors and to serve as a resting place.

Number of trees had been planted or protected along the road sides and many other points. Many of them have been lost during the super cyclone. Carefully selected indigenous evergreen trees and ornamental shrubs should be planted up fast to provide shade and greenery to the park.

Many exotic species of plants have been planted at different times in the zoo premises and even in the enclosures. There is need for phasing them out through replacement by indigenous species, carefully chosen. The park needs to be free from obnoxious weeds viz. *Lantana camara*, *Eupatorium odoratum*, *Mikenia macrantha,* etc.

Nursery:

Two nurseries for garden plants (seasonal and perennial) and another for trees or shrubs (for informal gardening) need to be maintained in the park. Large nursery is the absolute need for a modern zoo, for maintaining its greenery and aesthetic appeal.

Development of swamp:

The swampy land on the eastern side of the park to the north of the road need be properly landscaped and used for boating, while the main 'Kanjia' lake can be developed for resident as well as migratory birds and decoys be used to attract birds there. Few islands can be created there. Weeds are preventing the flow of water from the lake and which requires manual cleaning from time to time. A portion can be left up-spoilt for use by water birds viz. jacanas and purple moorhen here.

The Katurighasa pata which is a potential wetland on the back side of zoo hospital need to be restored by deweeding and desilting. This would serve the future need of water supply system for elephants and carnivores.

Development of lawns and gardens:

New lawns have been developed near FRH, mugger pool, gharial pool, orchidarium, Boat Ghat area, near library and water Bird Aviary. Sitting arrangements have been provided to the visitors to enjoy the scenic beauty of the Kanjia lake in Boat Ghat lawn, FRH and water Bird Aviary lawns. Dust bins have been provided to collect the sold wastes on the lawns. The flowering plants are affected by the free ranging Spotted Deer during night hours. The lawn near Mugger, Gharial Pool is improved with sprinklers sitting arrangements, visitor path etc. The flower beds in the new Gate Complex have been improved. The marshy lands in the parking place have been converted into a Lilly pond.

2. (c) (xii) Any other section peculiar to the zoo

Revenue section- Automation of ticketing system is required to enhance revenue generation and to prevent pilferage of revenue.

2. (c) (xiii) New initiatives in the zoo

NKZP must focus on conservation of endangered species of the region rather than maintaining a large collection of diverse species of animals. For this purpose, the zoo has to put considerable emphasis on technical knowledge on husbandry practices, proper up keep, designing suitable enclosures simulating the natural habitat of the animal.

The zoo must give more thrust on successful reintroduction of endangered and threatened animals into wild after captive breeding. Some of the species identified might be Indian Pangolin, Gharial, tiger, Bengal vulture, mouse deer etc.

Nandankanan Zoological Park to come up with need based research projects so as to develop protocols in the field of controlling serious diseases viz. Feline-pan-laucopinia, Tripanosomiasis, viral hepatitis etc. Similarly, extensive field research to be carried out on environmental enrichment of captive animals, population control, prolific breeding animals, sound husbandry practices, stress management in captive animals etc. A research Advisory Council involving zoo management and research Institutes and organization need to be set-up for promoting research on pertinent problems of the zoo so as to find out some tangible solution in future

In the present Master Plan, it is proposed to establish new Amphibian Park, Butterfly Park, Herbivore Safari and a modern Visitor Interpretation Centre.

Nandankanan Zoological Park must endeavour to extend collaborative population management programme with other zoos for a few identified endangered species. This may be wild buffalo, hornbill, four horned antelope, swamp deer, hog deer, mouse deer etc.

With the changing public perception, the zoos must set standards and norms for professional and scientific management of zoos. For this the zoo has to lay down required rules and guidelines with respect to burning issues viz ethical norms, plans and programmes for population control, designing immersion type naturalistic enclosures, improving animal health etc. More initiatives will be taken for introduction of innovative ideas and actions with reference to the global zoo management.

The zoo must endeavour to imbibe conservation education value in the minds of students who visit the zoo every time. This usual have attitudinal changes in the mind of children towards conservation of nature and natural resources. Zoos are centre of learning. Therefore Nandankanan Zoological Park must give more emphasis in future on conservation educational front by collaborating with schools, colleges and research institutions and by organizing nature camps, popular talks, competition etc.

In order to share information across the zoos at regional level, national level and global level, NKZP has become a member of World Association of Zoos and Aquariums (**WAZA**). Further zoos must endeavour for exchange of zoo staff for short term specialization training on specific field which would help the management in capacity building, solving certain problems etc.

Renovation of gharial pool

The existing gharial pool was constructed in the year 1976. The depth of the pool was 30 ft. near the mid-point. At present the pool requires desilting. The pool has already attained its carrying capacity for which aerating system to be installed. Further the dry moat on the viewer side near stand off barrier need to be renovated.

Desiltation & Deweeding of Kanjia lake:

The water storing capacity of the 66.1 ha. Kanjia Lake is reducing year after year due to siltation. Eutrophication is creating problems for existing biodiversity of the lake.

The salvinia and other weeds need to be cleaned from time to time while a portion of the lake close to Botanical garden on North-eastern side need to be preserved as undisturbed area for water birds. There is urgent need for taking up desiltation programme to enhance the water storage capacity of the lake. Further the upper catchments area of the lake to be protected to maintain stream flow. The drain towards eastern side of lake to be kept cleaned with suitable sluice gates to maintain water level in the lake.

Desiltation & Deweeding of Katurighasa Pata:

Due to non-maintainance of floating and sub-merged weeds, the Katurighasa Pata is loosing its water storage capacity. Therefore it is proposed to take up desilting and deweeding programmes to enhance the storage capacity of this wetland. The water can be used for maintainance of moated elephant enclosure, tiger enclosures, zoo hospital, pangolin centre, quarantine, etc in future.

Staff quarters:

Residential accommodation for the officers, vets, field officers and staff will be constructed early outside the Zoo premises. Their accommodation and availability at the park itself is important and crucial.

All staff whose presence is essential in the park premises need be provided with accommodation outside the park, preferably in the colony.

Relocation of staff colonies- The existing colonies situated within the premises of NKZP need to be relocated outside the zoo and need to be settled behind the Nandankanan High School area.

Mobility:

Atleast three new vehicles need to be provided for movement of officers, zoo vets and security personnels. Dedicated vehicles are to be provided for feed transportation, sanitation, anti-depredation squad etc.

Strengthening anti-depredation unit

The existing anti-depredation unit need to be strengthened by providing a modern anti-depredation unit vehicle fitted with movable search light, siren system, potable cages, VHF set, ropes and tackles, ladder etc. The staff of the anti-depredation unit would be given specialized training to upgrade their skill by deputing to other zoos for exposure visit.

Zoo school

The zoo school was formally opened on 29th December, 2003 on the occasion of 44th Foundation Day of Nandankanan Zoological Park. It is a platform where students get opportunities to learn about wild animals through special designed awareness programmes. These programmes are interactive, innovative, enrich learning. The students get an opportunity to learn and disseminate the need for conserving the wildlife. However the zoo does not have a permanent zoo school for zoo education centre for formal education and training programmes. Therefore it is proposed to upgrade the existing zoo education centre/zoo school to run regular awareness and education programmes for school children.

Personnel Policy for Nandankanan

The assessment of the personnel required for smooth management of the zoo is reviewed and assessed periodically. At present, the Director of the zoo is of the rank of Conservator of Forests. He is assisted by one Deputy Conservator of Forests, designated as Deputy Director with effect from 2003 and one Assistant Director of the rank of Assistant Conservator of Forests. In addition to this one Senior Veterinary Officer, Veterinary Assistant Surgeon for veterinary care are at the zoo. One Leave Reserve Officer of Veterinary Deptt. Of Orissa is also posted to the zoo for assisting the S.V.O. & V.A.S. The present grade wise staff strength of the zoo is as follows:

Grade of staff	Sanctioned Strength	In Position
A	3	3
B	2	2
C	85	51
D	75	64
Total	**165**	**120**

Miscellaneous

Since the zoo shall almost undergo a complete modernization within the period of this master plan, it is necessary to give special attention to the following aspects of execution.

i) As far as possible, emphasis shall be given to providing large space to each exhibit, provide dry, wet or concealed moats as per the need of the species.

ii) Excessive exposure of concrete structures need to be avoided and effort should be made to give special effects to barriers and night shelters and cubicles for merging them with the surrounding or to give a look of the animal habitat. Concealment of barriers by arranging creepers or vegetation can also give good effect. Immersion type exhibits would be constructed.

iii) Wherever possible, natural vegetation need to be protected and nurtured.

iv) Use of laterite blocks or sand stone etc, need to be preferred to concrete.

v) The enclosure need not be designed in isolation. All aspects of the surrounding area including other enclosures, topography and vegetation need to be taken into consideration for design and lay out of the new enclosure. For this purpose it will be better to use the services of the landscape architect.

vi) All structures need to be painted with a selected colour which need to merge with nature instead of using very bright colour.

vii) No tall structure above the tree height need to be erected within the park as that will spoil the landscape of the park.

viii) Build up area in no case, be more than 10% of the area use for the zoo.

ix) Special attention has to be given for planting indigenous trees as the park has lost many of its trees due to the super cyclone of 1999. Special emphasis need to be laid to planting along the roads and inside the enclosures with due planning.

x) All guidelines and rules and directions of Central Zoo Authority of India and other statutory bodies should also be kept in view while planning new developments so that they are not violated.

xi) Education and interpretation need to be given top priority in any future development of the zoo.

2. (d) Peculiar problems of the zoo/conservation breeding centre/Rescue centre

Adopt-an-Animal

In order to popularize adoption of animals among public, sincere efforts are being taken. However it is proposed to involve various industries, mines, companies and interprenures by organizing seminars and symposiums. Zoo volunteers system need to be introduced involving college, universities students, credible NGOs and wildlife lovers so as to make this programme successful. This programme would create awareness among public for conserving wildlife.

Rajbhawan Deer Park

It is contemplated to take up replacement of all old chainlink mesh fence of the Rajbhawan Deer Park. The chainlinks to be fixed over 2 ft. high laterite stone wall to strengthen the fence. New isolation unit, drinking water troughs, feeding platform, tree guards would be provided. Colouring of chainlinkmesh with black paint would be taken up to enhance the visibility and durability.

White backed vulture conservation breeding centre

India has nine species of Vultures in the Wild. These are the Oriental White-backed Vulture (*Gyps bengalensis*), Slender billed Vulture (*Gyps tenuirostris*), Long billed vulture (*Gyps indicus*), Egyptian Vulture (*Neophron percnopterus*), Red Headed Vulture (*Sarcogyps calvus*), Indian Griffon Vulture (Gyps fulvus), Himalayan Griffon (*Gyps himalayensis*), Cinereous

Vulture (*Aegypius monachus*) and Bearded vulture or Lammergeier (*Gypaetus barbatus*). The population of three species i.e. White-backed Vulture, Slender billed vulture and Long billed Vulture in the wild has declined drastically over the past decade. The population of the Gyps genus is declined drastically over the past decades. Vultures are passing through a crucial stage in India. The decline of Gyps genus in India has been put at 97% by 2005. Gyps species are huge in size and heavy birds with a wing span of over 2.5 m. They are obligate scavengers; long-lived, reach maturity at 4-6 years and constitute 99% of the total population of Vultures. These are colonial feeders, colonial or semi-colonial nesters, nest on trees or cliff (not too specific in site selection).

Even the population of Indian White-backed vulture is in catastrophic decline through recent years. Vultures were surveyed in India in 1992 (before the decline started) and again in 2003. For the Indian White backed Vulture in 1992 number was more than 100 times than the 2003 number. In other words, for every 100 Indian White-backed vulture counted in 1992, were less than one in 2003. If such decline continues, all White backed Vultures will soon be extinct from nature. In the last few years, first disease and then conclusively, a drug Diclofenac has been identified as the cause of the massive vulture die off. Although they are classified with Birds of prey but they virtually feed on carrion or dead animals.

Proposed time frame for conservation breeding

Capture of birds including nestlings would be carried out during first and second year of establishment of the center. The proposed time table for the conservation breeding envisages the capture of 40 birds including nestlings, during the next breeding season. They would form the founder population i.e 40 birds. First breeding in captivity is expected only from year-2012. The first release is expected two years there after i.e. in the year 2014 onwards. Fifty pairs are expected to be released by the year 2022 if everything goes well.

Housing for Vultures

Birds would be in captivity and hence would need specialized care and nursing to live and survive. Wild birds are extremely nervous and likely to struggle for right choice of construction material. The size of the pens should give ample space to them to do their entire daily chore so that they feel at home.

The pens should not be very large as it would make it difficult to catch or monitor them. There should be a clear span in the aviary for the free movement of the housed birds. Vultures need lot of water to bathe and drink, so provision for clean water- in large water trough inside the aviaries

would be provided. Shaded areas would be provided in the aviaries where Vultures can take shelter when it rains. Preferably non conducting material would be utilised for providing shade. The colony aviary would be of proper dimension to facilitate the above need. In addition to the above Quarantine aviary, nestling or nursery aviary and hospital aviaries would be established.

Since it is a highly technical activity and would involve some of the skilled job like trapping the birds from wild and their specialized handling so for development of the center professional assistance of the research organization like BNHS,IVRI would be sought as has been done in case of Pinjore Vulture Conservation Breeding Center ,by the Haryana Forest Department. Since the entire project activities would be highly speicialised and technical one, so the collaboration with the technical institutions like BNHS, WII, IVRI and RSPB would be explored and given priority.

The Vulture Conservation Breeding Centre (VCBC) at Nandankanan has been set up in off display area on the north-west corner in Botanical Garden, which is away from zoo area. The Conservation Breeding Center has been established inside Nandankanan wildlife sanctuary area especially in the State Botanical Garden to avoid any sort of human interference. A green belt will be maintained around the breeding centre to minimize the biotic interference. The site loction map of the said center is enclosed herewith as **Annexure-VII(b)**. The area of the VCBC is about one acre. The area has been fenced by laterite stone wall. The nursery cum hospital aviary has already been set up. The construction of main aviary is in progress. The area has been adequately screened to prevent disturbances and human contact.

Pangolin Conservation Breeding Centre at Nandankanan

Indian Pangolin

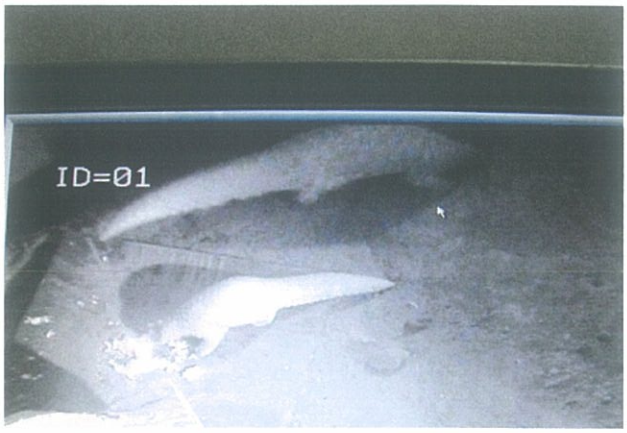
The Conservation Breeding Center for Indian Pangolin has been set up in the off display area of the Zoological Park which has been adequately screened to prevent disturbance and human contact.

Pangolins belong to order 'Pholidota' means scaled mammals and represented by the only genus '*Manis*'. There are eight species of pangolins distributed in the world out of which four species found in Africa and four in Asia. India representing two species i.e. Chinese pangolin (*Manis*

pentadactyla) and Indian pangolin (*Manis crassicaudata*). Indian pangolin occurs sporadically throughout the plains and lower slopes of hills from south of Himalayas to Kanyakumari in India.

As the wild population of the Indian pangolins is in a dwindling condition, Nandankanan has taken a step ahead to adapt scientific husbandry practices through captive breeding and its reintroduction to their natural habitats. As there are very least work has been published regarding its breeding behavior and reproductive biology like gestation period, estrous period, activity pattern etc; a research project has been initiated with the financial support from Central Zoo Authority (CZA) to document all the possible aspects of these endangered animals.

On the basis of the prototype, enclosure of dimension 4.5x4.8x3.0 meter high was constructed in an off display area of the zoo to minimize the human interference. The base of the enclosure made concrete with 5 X 5 cm chain-link mesh within to prevent the escape of the animal. The base was filled with soil mixed with small stones to stimulate the burrowing habit of the animal. Infrared sensitive CCTV cameras were installed in each enclosure to monitor the behavioural pattern of the animal during the night time. The pangolins were supplied with the red weaver ant (*Oecophylla smaragdina*) as their food. In case of unavailability of this natural food, they were provided with boiled eggs mixed with Amulspray powder as an alternate food.



In the newly constructed breeding centre, two births have been recorded so far on 17th July '09 and 28th August '09 respectively. The mothers along with their young ones are very healthy and active during the evening period and having their food regularly.

Water monitor lizard

At present the water monitor lizard are breeding inside the existing enclosure of reptile park. Since this is a schedule-I species

of Wildlife (Protection) Act, the enclosure need further enrichment to accommodate new born water monitor lizards. Due to suitable environment, the population of water monitor lizards it likely to increase in future and the surplus population will be released to their former habitat.

Rescue & rehabilitation of wild animals including leopards, sloth bears & monkeys

It is proposed to construct rescue and rehabilitation centre for leopards, sloth bears and monkeys. All these rescue centres to be established in off display areas of the park. Extra staff and officer need to be provided for smooth management of these rescue centres.

Establishment of herbivore safari

Already 34 ha. area of natural forest has been earmarked for establishment of herbivore safari near western side of the park. The surplus spotted deer, sambar, blue bull, barking deer etc. of the park will be accommodated in this safari. Provision of water, supplemental feed, salt-lick etc. will be provided. One watch tower has already been constructed during 2009 on the one corner of the safari for watch & ward purpose.

Nursery for the orphaned youngs

NKZP has the experience of rearing orphaned elephant calves, leopards, bears etc. One exclusive facilities is available for rearing orphaned elephant calves.

Sterilization centre for monkeys

One sterilization centre for monkeys will be constructed near zoo hospital to stop prolific breeding activities inside the park. The monkeys are creating problems for the visitors for which many monkies have been captured and relocated far away places.

Establishment of butterfly park

So far 85 species of free-living butterflies have been documented inside the park. The host plants of the above butterflies have been listed out. Therefore, one butterfly park is proposed to be established for display of butterfly biodiversity of the park.

Establishment of Amphibian park-

The park has got great diversity of amphibian population due to presence of Kanjia lake, Katurighasa pata and other small water bodies inside enclosures. Therefore it is proposed to establish one amphibian park for education and awareness purpose.

PART-II

CHAPTER-III

PERSONNEL PLANNING

3.1 Proposed cadre strength-

In the formative years of the zoo, mostly casual labourers were engaged who have neither required qualification nor adequate skill for carrying out certain task. However, most of them have acquired required skill over the years basing upon their experience and long association with permanent staff and experts in these fields. Services of a few of these casual labourers have been regularized over the years. Some of them have been imparted training in specialized fields and some of them have been sent for training to other zoos outside the state. For captive rearing of elephants, experts and trained mahuts from Assam had been used earlier.

The permanent staff are being given specific job based upon their ability, attitude and interest. They are to be given newer assignment to break the monotony after certain period. Many of them have developed specialized skills and expertise in certain fields for which they have to be retained for longer periods.

The staff at the grass root level does not enjoy any promotion opportunity and careers advancement while serving in the zoo. There is no motivating factor or mechanism to boost their moral in long run. This frustrates them for which their output diminishes as they become older. To boost the moral of the temporary staff, financial incentives are being paid. At present there is no biologist working in the zoo. It is proposed to create one post of biologist and one post of Education Officer in the zoological park.

3.2 Staff recruitment

There are large scale vacancies in various cadre of the zoo for which it is proposed to fill up these vacant posts either through promotion or through recruitment.

The ardous nature of work and specialized skill involved in various category of the zoo need to be considered as essential service and all such vacancies need to be filled up expeditiously by the State Government. There are certain important and specialized jobs in the zoo management viz. animal management, sanitation inside the enclosures, feed distribution for which no outsourcing is desirable.

3.3 Work outsourcing

In the present condition it is better to execute certain works by outsourcing to service providers, private agencies or even credible NGOs who have desired expertise, skill and trained manpower. This would enhance the capability of the management and would reduce botheration in terms of time and effort. Outsourcing of sanitation outside the enclosure area, parking area, toy train, boating, food court, cloak room, safaris have already been outsourced over the last 3 years. Outsourcing of the nature shop, aquarium, maintenance of electricity, lawns, gardens, toilets etc.following works of NKZP will be taken up as due course of time.

PART-II

CHAPTER-IV

DISASTER MANAGEMENT

Anticipated Disasters- Both natural and manmade disasters need to be tackled expeditiously so as to minimize response time with least possible damage to people, animals and properties. The anticipated natural disaster includes fire, flood, cyclone, earthquake, heat wave, cold wave etc. The anticipated man-made disaster includes fire incidence, shelter collapse, food poisoning civil disturbance etc.

4.1 Fire- Incidence of fire may be within the animal facility or other places within the zoo premises. Fire incidence inside natural forests within zoo area can be tackled by deploying the existing staff in security as well as animal sections. In case the fire is detected within the animal facility, then attempt would be directed for immediate removal of the animals to safer zone. The staff would utilize discretionary judgment on the spot to minimize response mechanism. Fire extinguishers in the administrative office and zoo hospital are kept ready for such eventuality. The electricity circuit breakers need to be turned off in case the fire is due to breakdown of electricity supply line. The electrician of the zoo needs to be pressed into action immediately.

4.2 Flood- NKZP is vulnerable to severe flood situation due to presence of two wetland ecosystems viz. Kanjia lake and Katurighasa pata. The contingency plan for dealing with exigency associated with flood includes construction of an alternate water supply system and storage tank. As the existing pumping station near boat ghat is likely to be submerged and defunct during severe cyclonic flood situation thereby disrupting supply of safe drinking water to animal enclosures and staff colony. To avoid use of contaminated water, another Chlorination Plant is proposed to be set up. Water tanker is already available in the zoo which can be put to use during flood for supply of safe drinking water.

4.3 Cyclone- The zoological park is quite vulnerable to cyclonic storms as seen during super cyclone of 1999. To combat the situation in the aftermath of cyclone, the zoological park has already procured two power chain saws to remove uprooted trees from the main and feeder routes. Further the existing 200 KVA generator needs to be linked with electrical cables for supply of electricity and running electrical pump sets. The overhead electricity supply is always vulnerable to cyclonic winds and torrential rains due to presence of thick vegetation. Water tankers, vehicles with POL, stored food grains, search lights, generators with POL etc. are kept

ready to meet the exigencies. Orissa State Disaster Management Authority (OSDMA) is being contacted to provide necessary help during the crisis.

4.4 Earthquake- Since, Nandankanan Zoological Park falls within the seismic belt of the state, adequate preparedness need to be ensured to mitigate the disaster due to earthquake. The essential equipments required during earthquake are gas cutter, earth moving equipment, helmet, protective gloves, shovel etc.

4.5 Heat wave- The zoo animals are vulnerable to heat waves experienced during summer months. The contingency measures includes utilizing the existing water tanker with spraying facility, hand sprayers, providing straw thatching, coolers, ice blocks, anti-stress medicine etc. A team consisting of zoo vet and sanctuary staff are deployed during mid-day in pinch summer period with water sprayers, ice boxes, anti-stress drugs for immediate treatment of sick animals suffering due to heat wave. Elaborate summer arrangement is ensured well ahead of onset of summer. Special seasonal foods are being provided to animals to reduce dehydration during summer months.

4.6 Cold waves- To mitigate cold waves during winter months, winter arrangements are being ensured in NKZP. This includes providing protective netlon coverings around bird enclosures, electric bulb in bird and snake enclosures, infrared lamps in Reptile Park, blankets to chimpanzees and orangutan. Special seasonal foods are also being provided to animals as nutritional supplements.

4.7 Law and Order Breakdown - In case of civil disturbance, it is the first and foremost duty of zoo authorities to evacuate the visitors to safer areas in an organized way to avoid panic and stampede. The help of police and district administration is to be taken to ensure safety of the visitor and to restore peace. The zoo has been equipped with alarm system in the administrative office, public address system in information centre of the gate complex and VHF networking system with zoo personnel for effective communication. It is also proposed to deploy private security to strengthen the existing security system with CCTV cameras on vantage points. A police Out-post already exists inside the zoo premises to deal with the situation.

4.8 Feed supply - At present live buffalos are being brought from Jadupur on the outskirts of Bhubaneswar by buffalo meat contractor. However in case of eventuality of law & order problem, the supply of buffalo meat would be seriously affected. Considering this one slaughter house has been set up in the western side of the zoo in an isolated area. Provision of electricity and water supply has already been made in the facility. In order to meet the exigencies it is

proposed to set up penning facility to keep extra buffalo stock at least for a week. One large deep freezer with back-up generator facility needs to be installed for meeting the exigencies. During strikes or agitation by workers and other staff, alternate arrangement for carrying out routine emergency zoo works are being ensured through service providers. The dry food is being stored for one month in advance to meet the exigencies.

4.9 Requirement of Tools - Some of the basic preparedness includes keeping essential equipments and materials viz. vehicle with POL, portable generators, chain saws, gasoline, freshwater, adequate supply of food stuff, poles, trap cages, nets, ropes, sirens, public address system, VHF communication system, rubber boots, protective gloves, helmets, shovels, pick axe, tranquilizing gun with drugs, welding machine with sufficient welding rods, fire proof dresses, goggles, rescue boats, etc. Trained and motivated staffs are to be kept in readiness round the clock to deal with problems in anticipating weather condition. The zoo will be closed for the visitors during the disaster period.

4.10 Linkages with others – The linkages of the zoo management with other line departments and agencies for managing the disasters viz. the police, district administration, OSDMA, fire brigade, credible NGOs, hospitals and other experts will be of definite help during emergency and disaster periods.

4.11 Line of Command – In order to facilitate rescue and rehabilitation activities during disasters, there should be proper line of command. The role of Director, Deputy Director, Assistant Director, Zoo Veterinarians, Range officers, etc. are clearly defined so that in the event of absence of any such officer, proper line of command would be maintained.

4.12 Training and Capacity building- Officers and staff at grass root level are being given proper training to work efficiently during disasters. Capacity building would enhance the ability and motivation level of staff to combat disasters.

4.13 Mock drills- In order to enhance the capability of the staffs, they are exposed to mock drills from time to time so that they would develop appropriate knowledge and skill to face various disasters in time. They are to be provided with appropriate equipments and trained manpower.

PART-II

CHAPTER-V

CONTINGENCY PLAN

5.1 Animal Rescued from wild

To accommodate the increased number of rescued wild animals and birds including leopards, sloth bears and monkeys, NKZP need facilities to manage them. A lot of wild animals are rescued from different parts of State every year. The rescued animals includes displaced, strayed out, orphaned and injured animals. Since there is no designated rescue and rehabilitation centre in the State, ultimately these rescued wild animals are to be accommodated in zoos. NKZP being a premier zoo in the country, most of the rescued animals are being rehabilitated in the zoo. Very few rescued animals are released in the wild after necessary treatment and keeping some time in quarantine if those animals are physically sound and suitable for rehabilitation in the wild. If the rescued animal required to be permanently displayed then it would be housed in quarantine area for a specific period before put to public display.

The common rescued animals include monkeys (langurs, rhesus macaques), sloth bear, Indian pangolin, mouse deer, spotted deer, leopard, common peafowl, barn owl, snakes etc. During 2007, one wild tiger was rescued from Satkosia George sanctuary which had gun shot injury. It is still under prolonged treatment in isolation unit. Most of the rescued animals are problematic animals viz. sloth bear, langurs and rhesus macaque. A few sloth bear are rescued from captive condition and these can be rehabilitated in the wild. One elephant calf was rescued from Keonjhar division during 2007 whose mother was run over by a speeding train. Rescued leopard cubs have been successfully hand reared in NKZP. The following actions need to be initiated for handling the rescued animals.

5.1.1 Trap cages

In order to capture problematic animals viz. monkeys, bears, leopards etc. in different parts of the State sufficient number of trap cages for different species are to be kept ready in zoo at any point of time. Trap cages for leopard and deer are also crucial. People for animal and other voluntary organizations are often involved in rescuing wild animals for which trap cages are to be kept ready which would also serve the purpose of temporary housing of the rescued/captured animals.

5.1.2 Vehicles

At present, only one pick up van is available in the zoo for attending animal rescue operations. However specialized rescue vehicle fitted with movable search light, siren system and VHF facility is needed. The vehicle must be capable enough to accommodate minimum six persons (Rescue team members) and the back side trolley must be able to accommodate large size cages. The vehicle needs to have some permanent equipments viz. ropes, tackles, ladder, cutting equipments etc. for handling and transportation of the animals.

5.1.3 Tranquilizing equipment and chemicals

Functioning of antidepredation unit- In order to address the problem of antidepredation throughout the state, a unit was established in NKZP with effect from 24th April, 2006. There are 5 sub-units functioning at Sambalpur, Baripada, Brahmpur, Balasore and Angul under the technical support of Nandankanan unit. The antidepredation unit office is functioning near the gate complex where all tranquilization equipments and drugs are being kept. For strengthening the antidepredation unit, the following activities are proposed to be undertaken.

- One middle level officer can be added to the team. Also one driver may be attached from Nandankanan.
- One full time vehicle, vehicle mounted visit set.
- VHF with multiple channels, spot light & siren.
- Telephone (Mobile) and Internet facility for better communication.
- A computer, laser printer, scan & xerox facility

5.2 Escape of animals from enclosures

At present Nandankanan Zoo has 8 ft high laterite stone wall completely around southern and western side. The eastern side is has partly protected by laterite stone wall and partly protected by swamps. Similarly the northern side is well protected with Kanjia lake which acts as a natural barrier. Therefore there is not much chance for the capture animals of the zoo to escape outside the zoo premises. The zoo staff routinely check all the perimeter chainlink fence of white tiger safari and lion safari. After getting clearance from the checking staff, the concerned Forest Guard informs safari staff to release the tigers and lions to safaris. Similarly the sanctuary management staff do mandatory checking of all enclosure fence, walls etc. before they leave. Utmost care is being given for safety of the public inside the zoo during park hours. The night security staff always remain vigilant and conduct routine checking of all enclosures during night hours and early morning to prevent any escape of captive animals.

Escape of zoo animals is sudden and creates emergency situations to tackle immediately. If the situation arises during zoo hours when visitors are in large number, the immediate job is to cordon of the area so as not to allow any visitors to approach the escaped zoo animal. Then to use the alarm system of the zoo to alert all staff including security. The anti-depredation team to be kept ready immediately to capture the escaped animal either through trapping or through tranquilization. For this two sets of the tranquilization equipments are to be kept ready one each with VAS and Range Officer, Sanctuary Management. Besides tranquilization equipment other protection weapons viz. 303" rifle, revolver etc. are to be kept in readiness. All responsible staff of the zoos must keep the telephone numbers of antidepredation team members and other key persons. In case or emergency the police, fire brigade, ambulance to be contacted over telephone and the required telephone numbers to be displayed at zoo hospital, Administrative building, security and sanctuary offices. One vehicle along with driver to be kept ready to meet emergencies. The trap cages are to be also kept ready with lock & key with designated officers.

For warning people & staff about emergencies

In emergency situation viz. escape of large cats, fire, law & order situation etc. there is need for proper evacuation mechanism in the zoo. For this Nandankanan Zoological Park has alarm system and public address system in the administrative building. Fixed station and walkie talkie (Radio communication) are available in the zoo. The vehicle mounted radio communication system is also available for passing on information.

The following safety measures are being taken to prevent escape of animals from enclosures.

(i) Escape drills conducted periodically among zoo staff to keep them more vigilant and well groomed.

(ii) Periodical trimming of trees are being carried out both inside and outside enclosure close to fence so as to avoid falling of branches which may serve as an escape route for capture animals viz. carnivores, primates and reptiles.

(iii) Moat water level is being maintained within the safety limit so that the captive animals who are good at swimming can not cross the barriers.

(iv) Repair and maintenance of doors, windows and annual painting chainlinkmesh fence is being done to prevent rusting.

(v) The animal keepers and their co-worker are sensitized during training and other interaction to prevent and deal with the issues of animal escape.

(vi) The stand off barrier and enclosures are meticulously designed so as to maintain the safety of visitors.

For dealing with animal escapes

Captive animals	Minimum requirement	Highly recommended but not required	What Nandankanan Zoological Park has
Elephant	Strong chains, elephant hook, tranquilization equipments and drugs, strong ropes	Elephant crush spare strong chains	Required chains, elephant hook, tranquilization guns and drugs.
Large carnivores	Transport crates, squeeze cage, tranquilization guns, equipments, blow dart, equipments, snare, nets, pole, syringes.	Spare transport crates with wheels	Transport crates, squeeze cage, tranquilization guns and equipments, blow dart, equipments.
Small carnivores	Transport crates, small squeeze cage, tranquilization guns, equipments, blow dart, equipments, snare, nets, gloves	Spare transport crates with wheels	Transport crates, tranquilization guns and equipments, blow dart, equipments.
Hoofed animals	Transport crates, tranquilization guns and equipments, blow dart, equipments, nets	Custom designed squeeze cages Transportation crates for various hoofed animals as per CZA guidelines	Tranquilization guns and equipments, blow dart equipments.
Small mammals including small primates	Nets, gloves, snare, pole syringes, blow dart equipments, crates, squeeze cage, plastic tubes	Appropriate crates	Blow dart equipments
Large primates viz chimpanzee	Nets, gloves, pole syringe, tranquilization guns and equipment, blow dart equipment.	Appropriate crates	Blow dart equipment, tranquilization guns and equipments.
Birds	Nets, gloves, towels, pole, syringe	Appropriate crates	A few cages
Reptiles	Nets, gloves, snares, plastic shield, plastic tubes, snake tong, snake hook, bags	Squeeze cage	Bags

Use of tranquilization gun and techniques of chemical restraint.

This is a very useful technique to capture problematic wild animals and zoo animals in distress so as to give them specific treatment. This can be an effective method for population control viz. Translocation, reintroduction hormonal implant and sterilization or for undertaking

research studies viz. Radio-collaring, Radio telemetry, satellite telemetry. This is a very skilled and specialized job as one has to know about immobilization system, the drugs, darts, use of tranquilizing and Radio collaring equipment etc. The drug doses vary and so also the kind of drug firm wild carnivores to wild herbivores. Various capture techniques should be imparted to staff and practiced by a specific group within the zoo. Although this facility already exists in Nandankanan, yet the same as proposed to be upgraded and smaller units can be created in adjacent wilderness areas.

Quick response unit

In order to tackle the problem of escape of animals from enclosures, one quick response unit comprising of Assistant Director, Range Officer, Animal & Sanctuary Management, Range Officer, Security, Veterinary Assistant Surgeon, depredation squad members and concerned animal keeper is being constituated. Necessary trap cages, tranquilization equipments and drugs are being kept ready to start trapping the escaped animal. Simultaneously evacuation mechanism of tourists is being taken up.

5.3 Free living Monkey & stray dog menace

Monkey menace- The population of free ranging langurs and rhesus macaque has gone up rapidly due to uncontrolled breeding inside the zoo. The langurs and rhesus macaques are being considered as pest and are frequently attacking visitors to snatch away eatables. There is no inter specific fights among langurs and rhesus macaque for which they are proliferating over the years. Monkeys are potential carrier of many dreaded diseases which may affect the captive animals of the zoo. They pose a great threat to visitors as well as to the captive animals of the zoo. The visitors used to feed the monkeys for which they become addicted to snatching and resort to biting if resisted by the visitors.

The following measure are being taken for controlling monkey menace

- Visitors are sensitized not to feed the monkeys.
- Herbivores are being practized to feed inside feeding stalls.
- Most of the rhesus macaque are being captured and transported to far off jungles.

- It has been contemplated to perform vasectomy and tuberctomy for captured monkeys as a population control measure with the cooperation of surgery department of Orissa Veterinary College, Bhubaneswar.

Control of stray dogs

Dog menace in Nandankanan zoo has been a problem over the years as stray dogs from nearby market area sneak into the park. In the past a few precious captive capture animals viz. Chowsingha had been killed by these stray dogs. The staff colonies are also luring the stray dogs who found it lucrative to stray inside. A few dogs some times forms a pack and even chase the free living spotted deer to kill. Dogs are also attracted towards bone pits where left over are being dumped. The stray dogs are potential threats to visitors and captive herbivores. Deer and antelopes are quite vulnerable to stray dog attack.

Special dog capture drives had almost eliminated the stray dog population in the past for some time. However fresh batches of stray dog used to sneak into the park through different gates. It is proposed to continue capture of stray dogs by trapping and tranquilization and releasing them in far off places either as such or after sterilization.

For controlling the dog menace within the zoo the following measures are undertaken.

- The possible breaches in boundary wall and chainlink separating staff colony near entry gate is being checked periodically.
- The security staff keep a strict vigil on entry of stray dogs through main gate.
- Dog capture drive is being undertaken periodically with the help of zoo staff, state animals husbandry department and people for animal.
- All zoo staff and registered guides are being sensitized to drive away the stray dogs from zoo premises.
- The wall height of the enclosures is being increased wherever there is chance of entry of stray dogs.
- During routine inspection whenever any breach in wiremesh is being noticed the same is being closed immediately.

Recommendation- Vasectomy & Tubectomy of captured stray dogs need to be performed within one Km. radius of the zoo boundary.

5.4 Arrangement of food in case of strike (non supply by contractors)

Storing of different feed items to tide over contingency situations such as strike periods by staff, Bands called by various political parties non supply of the feed contractors, natural calamities need to be considered much ahead of the real things. All dry feed to be kept ready in well maintained storage facilities at least for one month. Similarly perishable food items viz. fruits and green items to be procured and stored departmentally for atleast three days without banking upon the feed contractor. Existing deep freezing facilities to be upgraded to store perishable food items including buffalo meat, chicken and eggs at least for a week. Day old chick, white mice etc. to be kept ready at least for a week. Identification of service providers to be done much ahead to take their help to tide over the problem of EPF workers strike.

5.5 Snake bite

NKZP abounds with variety of snakes due to its natural vegetation and habitat conditions. There are free living poisonous snakes viz. cobra, krait, viper etc. in plenty inside the zoo campus. Moreover many poisonous snakes viz. King cobra, monocellate cobra, Binocellate cobra, Russell's viper, Banded krait are being exhibited in Reptile Park. The animal keeper who are working in reptile park are vulnerable to snake bite. It is mandatory to keep sufficient doses of anti-venom serum in zoo hospital to meet any emergency situation. Well maintained first-aid boxes are being kept ready at zoo veterinary hospital, Reptile Park, nocturnal house, Sanctuary Range Officer and administration building. The zoo keepers are being trained by zoo vets for first aid measures to be taken immediately in case of snake bite. Tetanus and antivenom injections are being kept for emergency uses in the zoo hospital. Occasionally captive animals are also suffer from snake bite for which immediate treatment is needed.

5.6 Visitors getting injured/visitors falling inside enclosure & First-Aid facility

Nandankanan zoo attracts more than 1.8 million visitors every year. In case of some accident, visitor falling inside the enclosure, monkey attack, snake bite or any sort of injury, the zoo must be equipped with first-aid kits at various points viz. toy train, boating, ropeway, children park, main gate complex, zoo hospital, administrative office, reptile park, nocturnal house etc. Certain emergency rescue equipments viz. ladders, rope, life jacket etc. are being kept ready. In case some visitors falls into wet or dry moat, there is telescopic aluminum ladder and rope available in administrative office to be used for rescuing. Animal keepers and security staff have been deployed on rotation to meet such situation. The anti-depredation squad members are being kept vigilant to meet any such untoward incidence in the zoo. Proper stand off barriers to

be erected to avoid falling of visitors to any enclosure moat. Proper do's and don'ts signages have already been fixed in important zones to reprimand the visitors. The visitors mostly get minor injury which can be treated at zoo hospital. However in case of serious injury, arrangement to be made for taking the injured visitors to nearest good hospital by the vehicles made available in the zoo. First-Aid facilities are available in the zoo hospital for minor injuries.

5.7 Fighting among animals

Infighting is noticed during rutting season of deer and antelopes among males. Similarly fighting is also noticed among carnivores, primates, crocodiles. In this case the fighting animals in case of carnivores one to be driven back to night shelter to avoid injury. Animal Keepers have been trained in this regard and with the help of rods they can separate the fighting animals. Occasional fighting occurs between mating pairs of carnivores for which their attitude and mating behavior, acceptability of the partner to be watched carefully before allowing them to actual start mating. Preferably zoo vets are to be kept standby with drugs and tranquilization equipments near kraal where mating of tiger, lion or leopards are allowed.

5.8 Epidemics

Outbreak of communicable diseases viz. Anthrax, Foot & mouth disease, Haemoragic septicemia etc. pose serious threat to captive animals in the zoo. The village cattle population surrounding the zoo is the potential source of outbreak of these diseases. Therefore ring vaccination programme is being taken up annually in coordination with State Animal Husbandry Department to prevent the outbreak of communicable diseases. The stray dogs and pet cats are also potential sources of diseases viz. Ehrlichosis, Feline-Pan-Leucopenia for which vaccination protocol is being taken up in the zoo. In order to prevent source of infection from fodder grass which were brought from outside has been stopped and captive fodder farm in the zoo has been upgraded for sustainable supply of quality fodder for zoo herbivores. The captive slaughter house in the zoo which is first of its kind in any Indian zoo has been set up to ensure proper check up of quality meat. The zoo vets meticulously do the ante-mortem and post mortem checking of the buffalo meat to prevent spread of any diseases to zoo animals.

5.9 Breakdown of power supply

In case of breakdown of power supply the zoo has a 200 KVA power supply for supply of water through pump sets. Sufficient fuel is kept ready at my point of time to run all generators and pump sets in the park. The gate complex and aquarium have been provided with 15 KVA & 25 KVA dedicated eco-gen sets. Invertors have been provided to administrative office, zoo hospital,

nocturnal house, ticket booking counter are also being provided to zoo hospital, conference hall as back up power supply provisions. Solar street lights have been fixed at entry point, fodder farm, Gate No.II, boat ghat, lake shore area, administrative office, Forest Rest House, solar home light system have been provided to zoo hospital, FRH, administrative office and officers quarters.

PART-II

CHAPTER-VI

CAPACITY BUILDING

The role of training is to launch support to and maintain the process of learning with objectivity, ultimately leading to the enhancement of management capability. While the pre-service training orients and prepares a prospective professional in meeting technical and administrative task, the in-service-training, often aptly referred to as continuing education is geared to enhance the professional capability.

6.1 In house Training

With dissemination of advance technology, imparting proper training should enhance knowledge of local staff. Training is thus indispensable at all levels and necessarily involves a wide range of training interests. It can be on the job training as well as a formal course oriented or study tour oriented training. It helps in maintaining management capability of the highest order. It may be reiterated that all the trained staff in forestry and wildlife management with some specialization on allied wildlife conservation & biodiversity management must be posted to zoo on a priority basis. All the zoo staff must be aware of latest trends in zoo management techniques

On the Job training:

(a) Collection of biological material & their interpretation

The zoo staff especially those who are working in Veterinary wing must be trained to collect biological material and to examine and interpret as and when required.

(b) Postmortem of wild animal carcasses and other wildlife health care

Often zoo management found themselves in a bewildering state and any sudden break out of any epidemics viz. Anthrax, Tuberculosis, foot & mouth diseases on Rinderpest in the wild. The local disease investigation unit of State Veterinary Department needs to be involved in this regard. Therefore the zoo staff should be involved in cooperative effort taken by local veterinarian in postmortem, collection of samples of vital organs for histo-pathological viral and bacterial examinations, their preservation and dispatch, signs & symptoms of common wildlife diseases, external indicators of health to be used for gross periodic health assessment. This sort

of training should be repeated at regular interval to make the practice more perfect. The help of Centre for Wildlife Health established in Orissa Veterinary College, Bhubaneswar is being taken. Further the blood samples of both zoo animals and wild animals (wherever possible) must be sent to High Security Laboratory situated at Bhopal, IVRI for testing.

(c) Use of computers internet and related accessories

A few staff may be trained in order to handle computer internet and such accessories. Knowledge on G.I.S. technique & remote sensing would be very essential in today's world which would be a very handy management tool. Various field data can be analyzed, stored and retrieved giving sanctuary management a update status.

Formal training courses

The officers need to attend various training programmes organized by CZA from time to time including the training for zoo veterinarians. Training is being organized for zoo keepers funded by CZA at NKZP.

6.2 To Encourage specializations

Since there is no rescue centre in the state of Orissa, Nandankanan Zoological Park acts as a Rescue & Rearing Centre for all problematic, orphaned and injured animals. In order to meet the exigencies one antidepredation unit has been set up in Nandankanan Zoological Park. The Veterinary Assistant Surgeon along with a team of dedicated and highly skilled staff are managing this antidepredation unit. They have been trained to handle all tranquilization and restraint equipments for this specialized operation. The zoo staff both at field level and official level are being send to various training courses in the country for specialization in the field of animal health care, zoo keeping, environmental enrichment, zoo education and interpretation, conservation breeding programme etc.

6.3 Annual rewards

In recognition of commendable performance in the field of zoo keeping, rearing of orphaned, in capacitated and injured/sick animals, gardening, security, maintenance etc. the dedicated staff are being rewarded on the eve of Zoo Foundation Day, Wildlife Week, Birth Day of animals, Elephant Day etc. The best maintained enclosures are also being awarded.

6.4 Recreation/Relaxation

In order to inculcate a feeling of togetherness and homeliness, it is proposed to set up a cultural centre with facilities for an auditorium and indoor games. In order to encourage the zoo personnel to show their inherent hidden talents, cultural evening and talent hunt show to be

organized. All the subordinate staff and zoo officials must have a family bonding to take the zoo to new heights. The zoo management should take all compassionate measures to encash a feeling of brotherhood so that there will be no agitation or grievance by the subordinate staff.

6.5 Training abroad

The Zoo Director, Deputy Director, Assistant Director and Zoo Veterinary Officers must attend specialized training courses abroad so as to gain upto-date knowledge on the relevant field which can be applied in our zoo.

6.6 Plan to upgrade skills of zoo staff

There is urgent need to train the existing staff to upgrade their skill in various aspect of zoo management from time to time. This will help the management for smooth running of the park.

6.7 Interaction with other zoos- Regional co-operation

It is desirable to have interaction with other near by zoos for regional cooperation in planned conservation breeding of endangered species.

PART-II

CHAPTER-VII

e-GOVERNANCE

With the boom in Information & Technology sector in the state, a lot of improvement has taken place for recording data and storage and retrieval system. Nandankanan has used GIS, Data base with the satellite imagery in collaboration with M/s Geo-envitech, Saheednagar, Bhubaneswar.

7.1 GIS Mapping

Using the GPS and satellite imagery the following maps have been prepared for Nandankanan Zoo and Nandankanan sanctuary.

1. Location and access of Nandankanan sanctuary
2. IRS ID LISS-III and PAN merged image of Nandankanan & its neighbourhood
3. Nandankanan sanctuary as viewed by high resolution satellite image
2. Core zone and buffer zone of Nandankanan sanctuary
3. Topography in core zone and buffer zone of Nandankanan sanctuary
4. Vegetation type by density classes in Nandankanan sanctuary & its buffer zone
5. Constitution of Nandankanan sanctuary by compartments
6. Landcover/landuse pattern in core and buffer zone of Nandankanan sanctuary
7. Map of existing waterholes in Nandankanan sanctuary
8. Location of wetlands in Nandankanan sanctuary and its buffer zone
9. Key areas of conservation importance in Nandankanan sanctuary
10. Administrative map showing districts, blocks & villages encompassed by core zone and buffer zone of Nandankanan sanctuary
11. Management plan showing proposed facilities in Nandankanan sanctuary
12. Map showing wildfire in Nandankanan sanctuary
13. Shaded relief map showing the landscape in core zone and buffer zone of Nandankanan sanctuary
14. Map showing cultural landscape around Nandankanan sanctuary
15. Map showing elephant corridors in and around Nandankanan sanctuary
16. Lithology in core zone and buffer zone of Nandankanan sanctuary
17. Protection map of Nandankanan sanctuary

18. Tourism map of Nandankanan sanctuary

All the enclosures, safaris, infrastructures, internal roads etc. have been mapped with the help of GPS. It is proposed to map the electric power supply lines, water supply system, chlorination pipe system etc.

7.2 CCTV's

Already four CCTV cameras have been fixed in Booking Counters, gate complex and ticket checking gate (Gate No.II) for monitoring the activities of visitor and staff. Proper surveillance on strangers and unscrupulous people is being done to avoid any problem inside the Zoo. It is proposed to fix CCTV cameras in feeding cubicles of tigers to record their activities. Further proposals for fixing CCTV cameras at different vulnerable points inside NKZP have been proposed for necessary survillence during night hours.

7.3 Wireless Network

The wireless network system has been strengthened inside the Zoo for better communication. There are two VHF towers, three vehicle mounted fixed VHF sets, two controlled fixed sets one each at Administrative Office and in Director's office. Further there are fifteen hand sets for better communication among different sections. There is battery backup system with chargers for effective communication.

7.4 Computerization of Office work

There are three computers in Director's office, four computers in Deputy Director's office, one computer in Assistant Director's office, two computers in Veterinary hospital and one in Sanctuary Range Office. There is a need for networking for all the computers by LAN. E-mail facilities are available in Director's office and Assistant Director's office. However due to frequent problem with BSNL server in Nandankanan the internet is not working properly. Further there is need for giving AMC to some agencies for maintaining all computers and peripherals.

7.5 Main Gate entry

At present there are twelve ticket booking counters in the gate complex. The ticket are being issued by using electronic ticketing machines. In peak tourist season i.e. during X-mass and New Year time printed tickets are being issued in extra four counters. However there is need for automatic ticket checking system using swiping of the bar-coded tickets at the electronic gates. The proposal is pending as the alternate road in lieu of existing thoroughfare inside the zoo

is finalized. Once the bar-coded system is introduced, the revenue pilferage problem will be automatically tackled.

7.6 Animal History

The existing maintenance of animal history records is obsolete and out-dated. Although many information including stud book, animal health care, inventory etc. have been computerized yet there is need for further up-gradation in view of many advance record keeping and information sharing system. The Central Zoo Authority will soon join the ZIMS (Zoological Information Management System) being coordinated by International Species Information System (ISIS), U.S.A. The ZIMS is a comprehensive software, consisting of the following, in addition to other features.

ARKS- Animal Record Keeping System

Med ARKS- Medical Animal Record Keeping System

SPARKS- Single Population Animal Records System

This would help exchange of information about Zoo activities and Animal Status and animal exchange programme.

7.7 World Association of Zoos & Aquarium (WAZA)

Nandankanan Zoological Park became the first zoo in the country to be a member of WAZA with effect from 3rd April, 2009. This is a very prestigious World Association responsible for strict implementation World Zoo Conservation Strategy. Each member of WAZA need to aspire for the highest standard of welfare for the animals in its care.

7.8 Web site & e-mail

Nandankanan zoo has setup a website www.nandankanan.org for information sharing. The e-mail IDs are info@nandankanan.org

PART-II

CHAPTER-VIII

BROAD BUDGET ANALYSIS FOR IMPLEMENTING THE PLAN

(I) Construction & Development (non-recurring)

Sl. No.	Particulars	Works	Amount Rs. in lakh
For first five years			
2010-11			
1.	**Development of zoo**		
a.	Construction of new enclosure	i) Hornbill enclosure	10.00
		ii) Pariah kite enclosure	7.00
b.	Modernization of existing animal enclosure	i) White tiger safari fence repair	5.00
		ii) Enclosure enrichment	5.00
		iii) Renovation of quarantine	2.50
		iv) Improvement of isolation ward	5.00
c.	Development/improvement of infrastructure	i) Boundary wall around zoo 250 mtr. 8 ft. high	8.50
		ii) Secondary wall around lion and white tiger safari- 375 m	10.00
		iii) Water supply system with deep tube well	4.00
		iv) Sewerage disposal with sewerage treatment plant	20.00
		v) Compound wall	21.70
		vi) Improvement of fodder farm	10.00
d.	Development of visitors facilities	i) Drinking water-kiosk 1 no.	2.00
		ii) Signage development	5.00
		iii) Visitor intepretation centre	12.14
		iv) Development of children park	2.16
		v) Development of Parking	3.00
e.	Capacity building	i) Training and capacity building	7.00
	Total		140.00
2.	**Development of Kanjia Lake**	i) Deweeding	15.00
			165.00
2011-12			
1.	**Development of zoo**	i) Upgradation of water supply	12.50
		ii) Augmentation of the existing low transmission line & providing AB cabling to support 33 KV transmission	10.00
		iii) Maintenance of enclosures and kraals	5.00
		iv) Repair of the fence of lion &	5.00

		tiger safaris	
		v) Repair of the partition wall of lion enclosure in Encl. No. 29-B	10.00
		vi) Renovation of sambar enclosure	3.00
		vii) Repair to the wall of Rhino enclosure	3.75
		viii) Strengthening of the wall of Hippo enclosure	0.75
		ix) Painting of enclosures	3.50
		x) Painting of the building	3.50
		xi) Maintenance of lawn & garden	2.50
		xii) Renovation of Reptile Park	5.00
		xiii) Development of an orientation centre at Reptile Park	10.00
		xiv) Renovation of nocturnal house	2.50
		xv) Up-gradation of the quarantine	2.50
		xvi) Augmentation of children's park	4.00
		xvii) Installation of automated entry system	42.50
		xviii) Signage	2.50
		xix) Brochure, maps & tickets	2.50
		xx) Annual Report	0.50
		xxi) Rescue centre for Leopard, Sloth bear, etc.	51.50
		xxii) Up-gradation of the road from cottage to boat ghat with RCC structure	3.00
		xxiii) Black topping of the road from nocturnal house to boat ghat	3.25
		xxiv) Construction of new toilets for visitors	7.00
		xxv) Development of the road from carnivore enclosure up to the end of zebra enclosure	7.50
		xxvi) Development of road from the main gate complex to the parking area	7.50
		xxvii) Avenue planting with tall trees	3.50
		xxviii) Environmental enrichment	10.00
		xxix) Construction of new Interpretation centre	100.00
		xxx) Establishment of Herbivore	100.00

		safari	
		xxxi) Establishment of butterfly park	50.00
		xxxii) Establishment of Amphibian Park	50.00
		xxxiii) Purchase of new vehicles	30.00
		xxxiv) Construction of staff quarters	30.00
		xxxv) Construction of compound wall	40.00
		xxxvi) Improvement of parking place including bus stand	50.00
		xxxvii) Training and capacity building	15.00
		xxxviii) Organisation of National workshop on Zoo management	30.00
		xxxix) Exchange of animals including transportation	5.00
	Total		724.75
2.	**Development of Kanjia lake**	i) Wetland education	5.50
		ii) Monitoring of water quality	2.00
		iii) Biological control of weeds	1.00
		iv) Management of free floating weeds/ deweeding	153.00
		v) Hydrological improvement	2.50
		vi) Fisheries resource development	1.00
	Total		165.00
			889.75
2012-13			
1.	**Development of zoo**	(i) Construction of new enclosures	20.00
		(ii) Improvement of existing enclosures	80.00
		(iii) Development/ improvement of infrastructures	20.00
		(iv) Development of visitors facilities	7.25
		(v) Improvement of road network	50.00
		(vi) Augmentation of water supply	50.00
		(vii) Establishment of sterilization centre for monkeys	20.00
		Development of Orphanage centre for young wildlife	30.00
		(viii) Interpretation centre at reptile park	30.00

		(ix) Construction of new maintainace workshop	40.00
		(x) Renovation of Rajbhawan Deer Park	30.00
		(xi) Signages	30.00
		(xii) Environmental enrichment	10.00
		(xiii) Construction of compound wall	40.00
		(xiv) Improvement of fodder farm	20.00
		(xvi) Construction of Zoo Education Centre	50.00
		(xvii) Establishment of new chlorination plant	20.00
		(xviii) Strenghening anti-depredation unit	10.00
		xix) Exchange of animals including transportation	10.00
	Total		567.25
2.	**Development of Kanjia lake**	(i) Weeding & disilting	40.00
		(ii) Wetland education	2.00
		(iii) Biodiversity conservation	3.00
		(iv) Improvement of hydrology	5.00
	Total		50.00
3.	**Development of Katurighasa pata**	(i) Weeding & disilting	20.00
			637.25
2013-14			
1.	**Development of zoo**	(i) Construction of new enclosures	20.00
		(ii) Modernization of existing enclosures	15.00
		(iii) Development/ improvement of infrastructures	20.00
		(iv) Development of visitors facilities	10.00
		(v) Construction of boundary wall	150.00
		(vi) Construction of overhead tank and setting up of pumping station for system of flowing water to the enclosures	100.00
		vii) Construction of staff quarters in relocated site	200.00
		viii) Construction of salt water crocodile enclosure	100.00
		ix) Construction of new zoo hospital building	70.00
		x) Signages	20.00
		xi) Environmental enrichment	10.00
		x) Construction of compound wall	390.00

		xi) Training and capacity building	10.00
		xii) Exchange of animals including transportation	10.00
	Total		1125.00
2.	**Development of Kanjia lake**	(i) Weeding & disilting	20.00
		(ii) Wetland education	2.00
		(iii) Biodiversity conservation	3.00
		(iv) Improvement of hydrology	10.00
	Total		35.00
3.	**Development of Katurighasa pata**	(i) Weeding & disilting	20.00
			1180.00
2014-15			
1.	**Development of zoo**	(i) Construction of new enclosures	20.00
		(ii) Modernization of existing enclosures	30.00
		(iii) Development/ improvement of infrastructures	15.00
		(iv) Development of visitors facilities (rain shelters, sit outs, pavements)	25.00
		(v) Construction of new primate enclosures	60.00
		(vi) Improvement and maintainance of roads	30.00
		(vii) Replacement of chainlinkmesh of lion and white tiger safari	90.00
		(viii) Construction of administrative building	70.00
		(ix) Environmental enrichment	10.00
		(x) Construction of compound wall	40.00
		xi) Training and capacity building	10.00
		xii) Exchange of animals including transportation	10.00
	Total		410.00
2.	**Development of Kanjia lake**	(i) Weeding & disilting	10.00
		(ii) Wetland education	10.00
		(iii) Biodiversity conservation	5.00
		(iv) Improvement of hydrology	10.00
	Total		35.00
3.	**Development of Katurighasa pata**	(i) Weeding & disilting	10.00
			455.00
For second five years			
2015-16			
1.	**Development of zoo**	(i) Construction of new enclosures	40.00
		(ii) Modernization of existing enclosures	30.00

		(iii) Development/ improvement of infrastructures	20.00
		(iv) Development of visitors facilities	20.00
		(v) Improvement of roads and stand off barriers	40.00
		(vi). Replacement of chainlinkmesh of lion and white tiger safari	50.00
		(vii) Construction for bamboo hut for visitors	50.00
		(viii) Upgradation of children's park	30.00
		(ix) Upgradation of quarantine	50.00
		(x) Installation of CCTV cameras in vulnerable points	50.00
		(xi) Purchase of vehicles	30.00
		(xii) Upgradation of aquarium with AC	50.00
		(xiii) Construction of a new nocturnal animal house	50.00
		(xiv) Environmental enrichment	10.00
		(xv) Construction of compound wall	40.00
		xiv) Training and capacity building	10.00
		xv) Exchange of animals including transportations	10.00
	Total		580.00
2.	**Development of Kanjia lake**	(i) Weeding & disilting	20.00
		(ii) Wetland education	2.00
		(iii) Biodiversity conservation	3.00
		(iv) Improvement of hydrology	5.00
	Total		30.00
3.	**Development of Katurighasa pata**	(i) Weeding & disilting	10.00
			620.00
2016-17			
1.	**Development of zoo**	(i) Construction of new enclosures	40.00
		(ii) Modernization of existing enclosures	50.00
		(iii) Development/ improvement of infrastructures	30.00
		(iv) Development of visitors facilities	20.00
		(v) Construction of new museum	50.00
		(vi) Replacement of chainlinkmesh of lion and white tiger safari	30.00

		(vii) Purchase of anti-depredation vehicle and equipments	20.00
		(viii) Construction of anti-depredation of squad office	20.00
		(ix) Environmental enrichment	10.00
		(x) Construction of walk-through aviary	100.00
		(xi) Purchase of vehicles	20.00
		(xii) Construction of visitor's path ways	30.00
		(xiii) Construction of compound wall	40.00
		xiv) Training and capacity building	10.00
		(xv) Improvement of fodder farm	20.00
	Total		490.00
2.	**Development of Kanjia lake**	(i) Weeding & disilting	20.00
		(ii) Wetland education	2.00
		(iii) Biodiversity conservation	3.00
		(iv) Improvement of hydrology	5.00
	Total		30.00
3.	**Development of Katurighasa pata**	(i) Weeding & disilting	10.00
			530.00
2017-18			
1.	**Development of zoo**	(i) Construction of new enclosures	40.00
		(ii) Modernization of existing enclosures	30.00
		(iii) Development/ improvement of infrastructures	30.00
		(iv) Development of visitors facilities	20.00
		(v) Improvement of lion safari and white tiger safari	50.00
		(vi) Construction of cafeterias	20.00
		(vii) Landscaping	50.00
		(viii) Environmental enrichment	10.00
		(ix) Signages	5.00
		(x) Construction of secondary wall around lion safari	100.00
		(xi) Construction of compound wall	40.00
		xii) Training and capacity building	10.00
	Total		405.00
2.	**Development of Kanjia lake**	(i) Weeding & disilting	20.00
		(ii) Wetland education	2.00
		(iii) Biodiversity conservation	3.00

		(iv) Improvement of hydrology	5.00
	Total		30.00
3.	**Development of Katurighasa pata**	(i) Weeding & disilting	10.00
			445.00
2018-19			
1.	**Development of zoo**	(i) Construction of new enclosures	40.00
		(ii) Modernization of existing enclosures	30.00
		(iii) Development/ improvement of infrastructures	30.00
		(iv) Development of visitors facilities	30.00
		(v) Construction of new conference hall	30.00
		(vi) Replacement of chainlinkmesh of lion and white tiger safari	40.00
		(vii) Environmental enrichment	10.00
		(viii) Signages	5.00
		(ix) Construction of secondary wall around lion safari	100.00
		(x) Construction of compound wall	40.00
		xi) Training and capacity building	10.00
	Total		365.00
2.	**Development of Kanjia lake**	(i) Weeding & disilting	20.00
		(ii) Wetland education	2.00
		(iii) Biodiversity conservation	3.00
		(iv) Improvement of hydrology	5.00
	Total		30.00
3.	**Development of Katurighasa pata**	(i) Weeding & disilting	10.00
			405.00
2019-20			
1.	**Development of zoo**	(i) Construction of new enclosures	40.00
		(ii) Modernization of existing enclosures	30.00
		(iii) Development/ improvement of infrastructures	30.00
		(iv) Development of visitors facilities	30.00
		(v) Water supply & storage system in ropeway station	70.00
		(vii) Replacement of chainlinkmesh of lion and white tiger safari	40.00
		(viii) Environmental enrichment	10.00
		(ix) Signages	5.00

		(x) Construction of secondary wall around white tiger safari	150.00
		(xi) Construction of new stand off barrier	30.00
		(xii) Installation of solar street lights	30.00
		(xiii) Construction of compound wall	40.00
		xiv) Training and capacity building	10.00
	Total		515.00
2.	**Development of Kanjia lake**	(i) Weeding & disilting	40.00
		(ii) Wetland education	2.00
		(iii) Biodiversity conservation	3.00
		(iv) Improvement of hydrology	5.00
	Total		50.00
3.	**Development of Katurighasa pata**	(i) Weeding & disilting	10.00
			575.00
			5902.00

(II) Day to Day Maintenance (Recurring)

(For each year on average)

Sl. No.	Item of works	Total fund needed Rs. in lakhs
1.	Cost of feed and fodder supplies, maintenance of fodder plot, zoo kitchen, feed store	150.00
2.	Maintenance of zoo hospital, cost of medicine, vaccines, liming, sanitation etc.	20.00
3.	Maintainance of Animal enclosures, water supply, electricity, lawn & gardens, internal roads, drainage system, security, buildings, ticketing system, signages, office including AMC, safaris, aquarium, visitor facilities, parking, etc.	200.00
4.	Wages and allowances	50.00
5.	Rajbhawan Deer Park	20.00
6.	Research	10.00
7.	Brochures, Annual reports, Schemes and Plans, preparation of maps using GIS technology	5.00
	Grand total	**455.00**

ABSTRACT

YEAR	FUNDS REQUIRED (In Rs lakhs)				TOTAL (In Rs lakhs)
	Development of zoo	Dev. of Kanjia Lake	Dev. of Katurighasa Pata	Maintenance of works	
2010-11	140.00	15.00	0.00	455.00	610.00
2011-12	724.75	165.00	0.00	455.00	1344.75
2012-13	567.25	50.00	20.00	455.00	1092.25
2013-14	1125.00	35.00	20.00	455.00	1635.00
2014-15	410.00	35.00	10.00	455.00	910.00
2015-16	580.00	30.00	10.00	455.00	1075.00
2016-17	490.00	30.00	10.00	455.00	985.00
2017-18	405.00	30.00	10.00	455.00	900.00
2018-19	365.00	30.00	10.00	455.00	860.00
2019-20	515.00	50.00	10.00	455.00	1030.00
Grand Total	**5322.00**	**470.00**	**100.00**	**4550.00**	**10,442.00**

Considering the changing scenario of the zoos world over, it is hoped that at the end of the planned period with the suggested inputs for development, Nandankanan Zoological Park shall be able to effectively achieve its objectives.

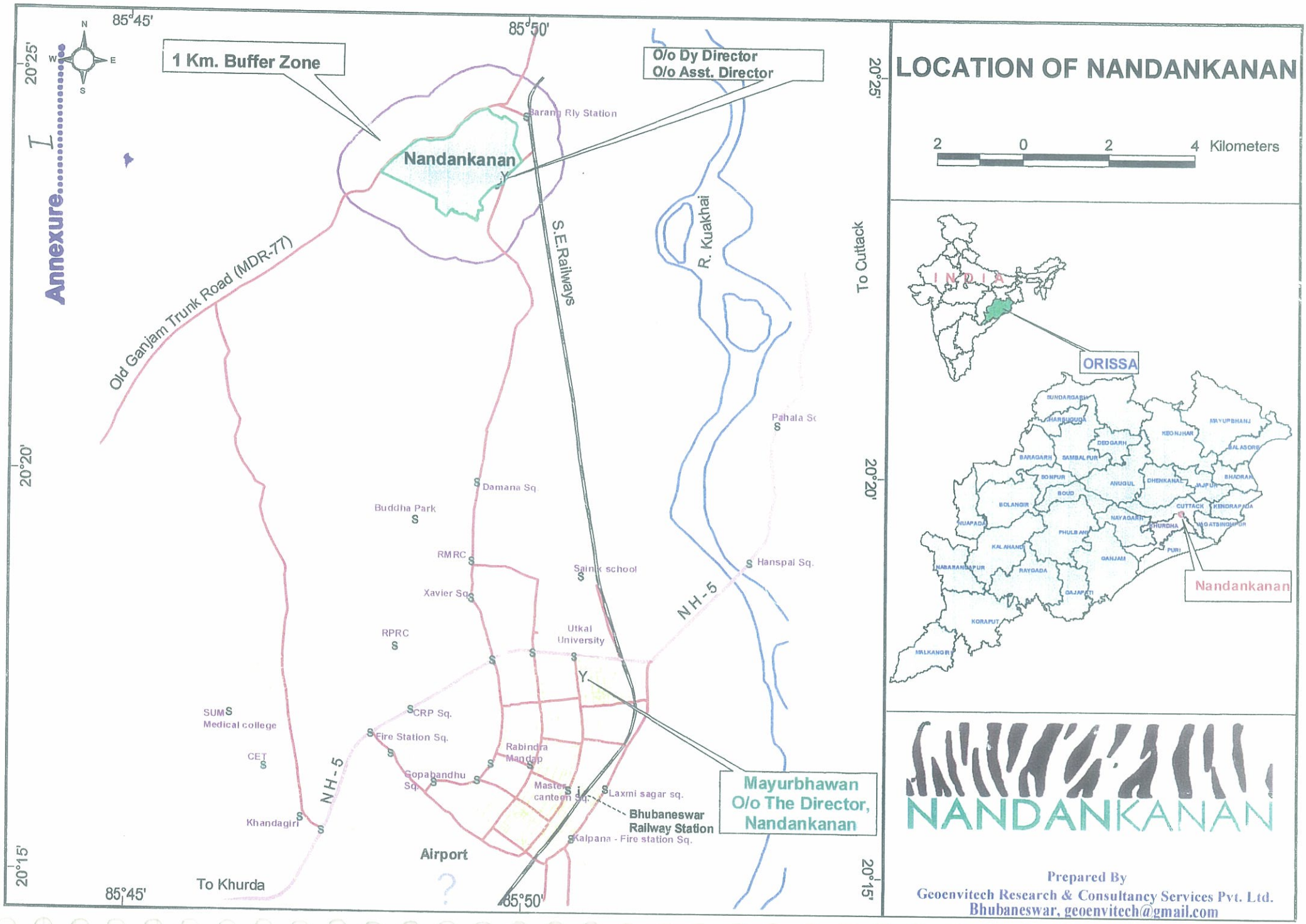
Director, 10.5.10

Nandankanan Zoological Park

DIRECTOR
Nandankanan Zoological Park
Bhubaneswar.

Annexure-I

Location map of Nandankanan


Annexure I
1 Km. Buffer Zone
Nandankanan
O/o Dy Director
O/o Asst. Director
Barang Rly Station
S.E.Railways
R. Kuakhai
To Cuttack
Old Ganjam Trunk Road (MDR-77)
Pahala Sc
Damana Sq.
Buddha Park
RMRC
Sainik school
Hanspal Sq.
Xavier Sq.
NH-5
RPRC
Utkal University
SUM Medical college
CRP Sq.
Fire Station Sq.
CET
Rabindra Mandap
Gopabandhu Sq.
Master canteen sq.
Laxmi sagar sq.
Bhubaneswar Railway Station
Khandagiri
Kalpana - Fire station Sq.
Airport
To Khurda
Mayurbhawan
O/o The Director,
Nandankanan
85°45'
85°50'
20°25'
20°20'
20°15'
LOCATION OF NANDANKANAN
2 0 2 4 Kilometers
INDIA
ORISSA
SUNDARGARH
JHARSUGUDA
MAYURBHANJ
KEONJHAR
DEOGARH
BALASORE
BARAGARH
SAMBALPUR
BONPUR
ANUGUL
DHENKANAL
BHADRAK
BOUD
BOLANGIR
CUTTACK
KENDRAPARA
NUAPADA
NAYAGARH
JAGATSINGHPUR
PHULBANI
KHURDHA
PURI
KALAHANDI
GANJAM
NABARANGAPUR
RAYGADA
GAJAPATI
KORAPUT
MALKANGIR
Nandankanan
NANDANKANAN
Prepared By
Geoenvitech Research & Consultancy Services Pvt. Ltd.
Bhubaneswar, geoenvitech@gmail.com

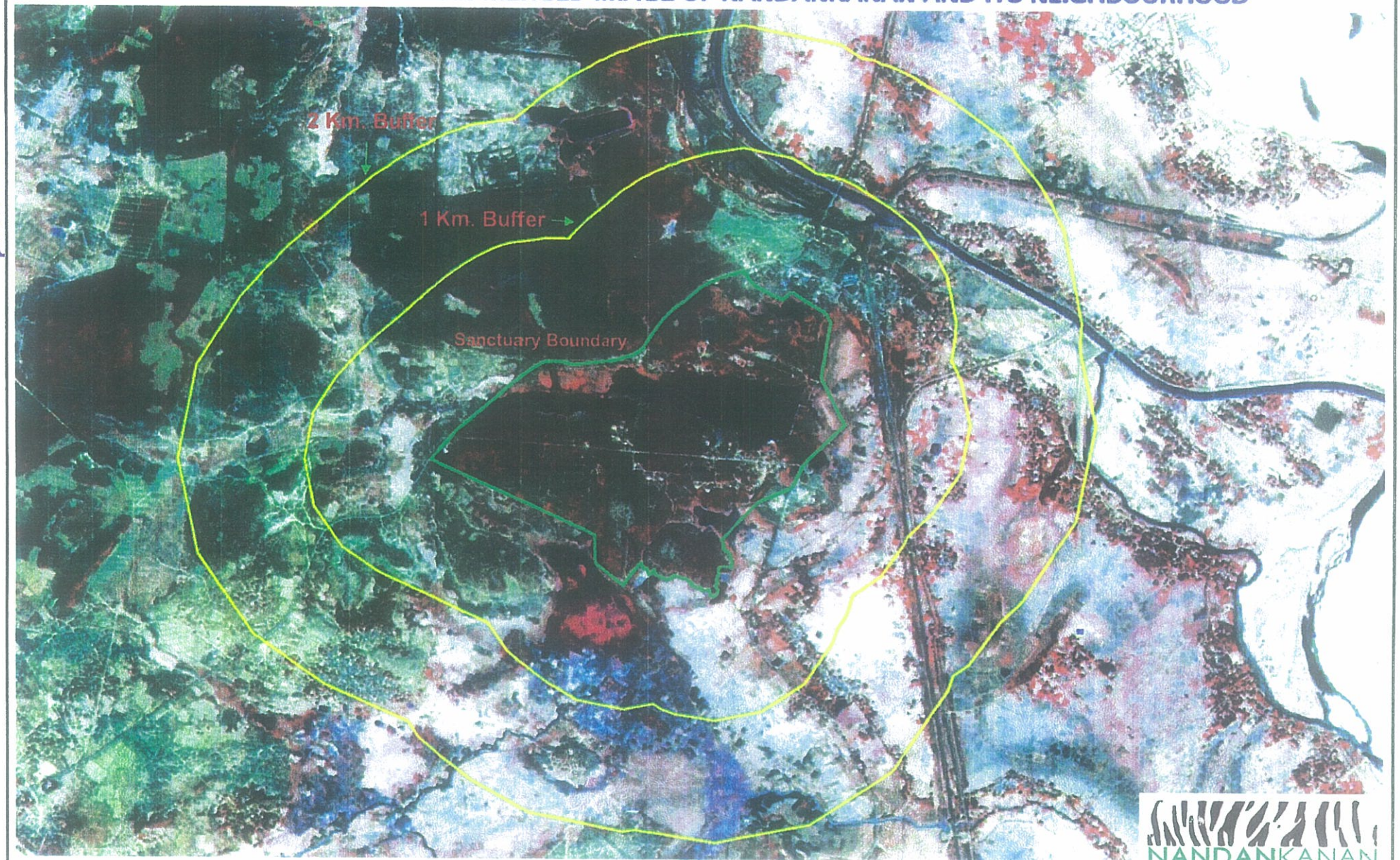
Annexure-II

IRS-ID LISS-III and PAN merged image of Nandankanan

Annexure II

N

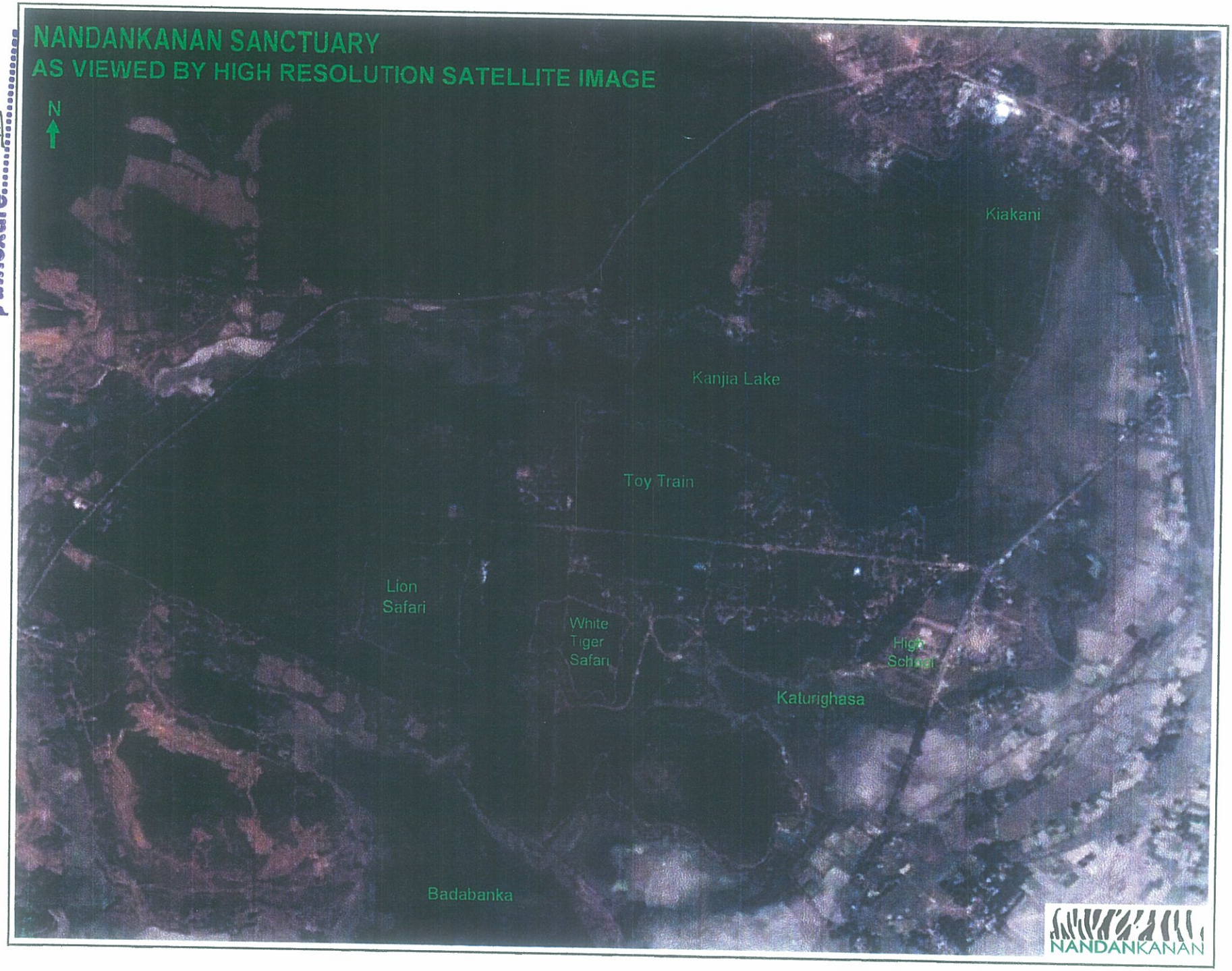
IRS 1D LISS-III AND PAN MERGED IMAGE OF NANDANKANAN AND ITS NEIGHBOURHOOD



Annexure-III

High Resolution satellite image of Nandankanan

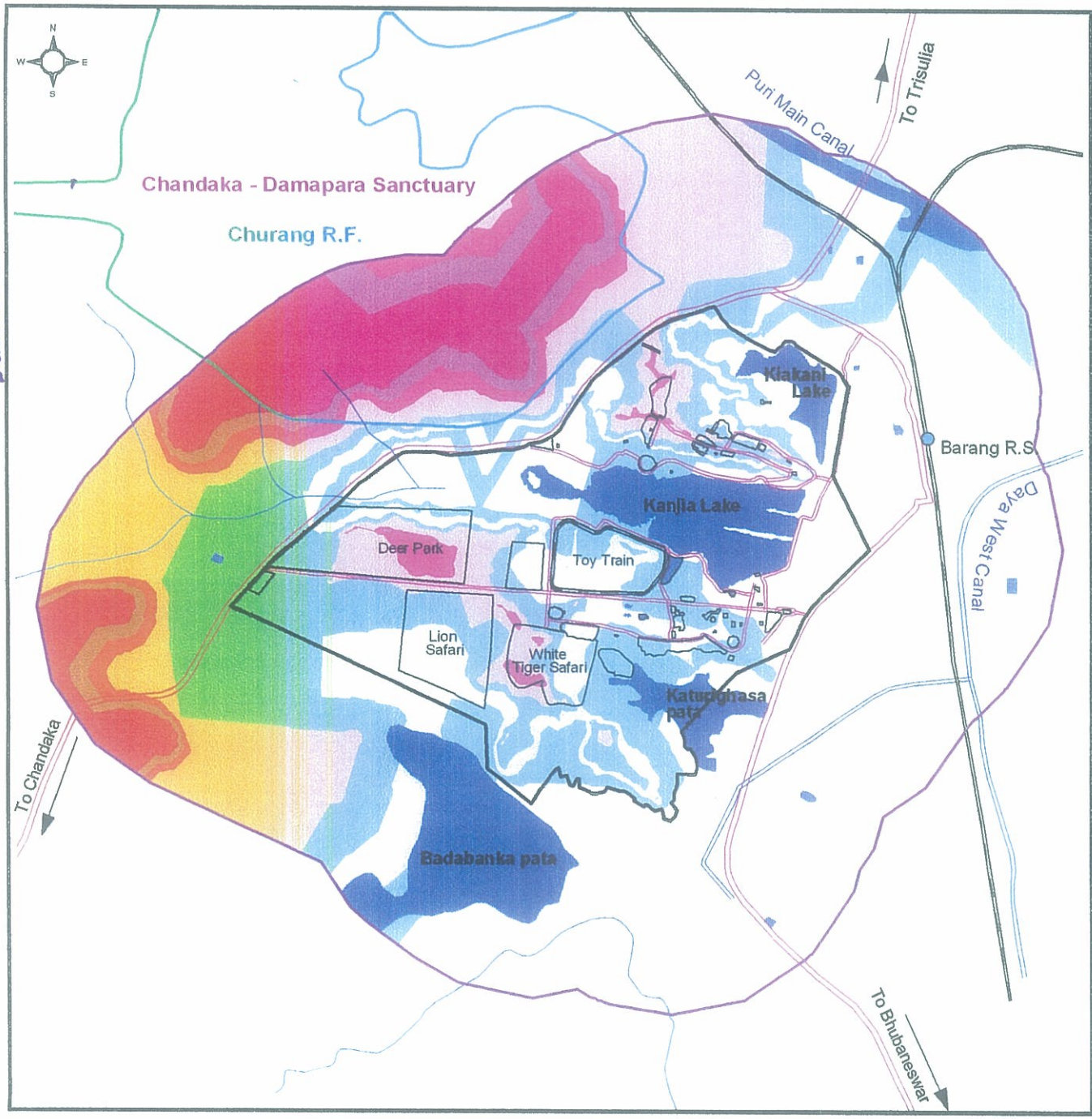
Annexure III



Annexure-IV

Map showing shaded relief and landscape of Nandankanan

Annexure.....IV.....



SHADED RELIEF MAP SHOWING THE LANDSCAPE OF NANDANKANAN

0.5 0 0.5 1 Kilometers

LEGEND

- Nandankanan Sanctuary Boundary
- R.F. Boundary
- Canal
- Streams/Nalas
- Major Roads
- Major Internal Road
- Other Internal Road
- Railway
- Water Bodies

Elevation (Above Mean Sea Level in Mtrs.)

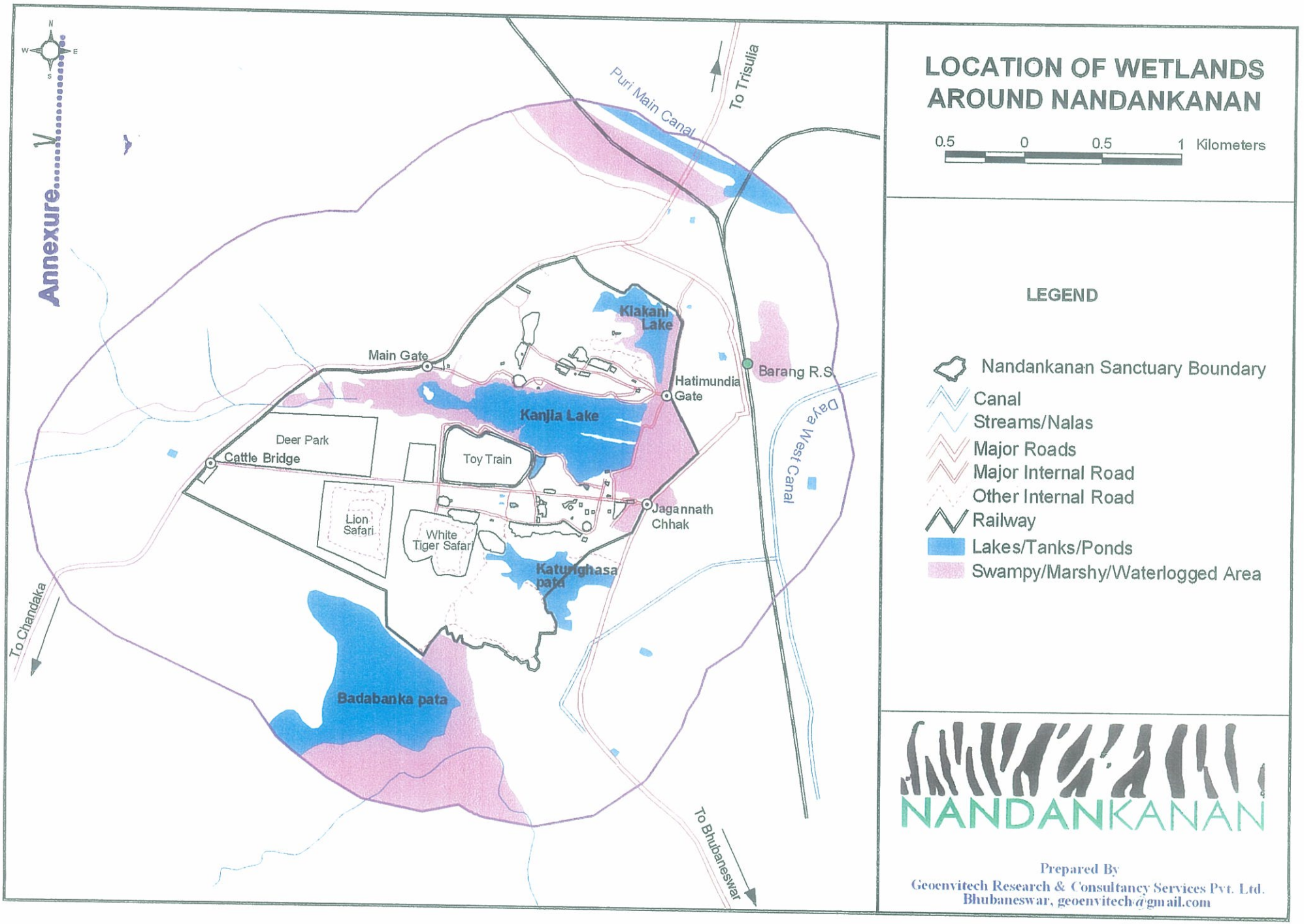
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

NANDANKANAN

Prepared By
Geoenvitech Research & Consultancy Services Pvt. Ltd.
Bhubaneswar, geoenvitech@gmail.com

Annexure-V

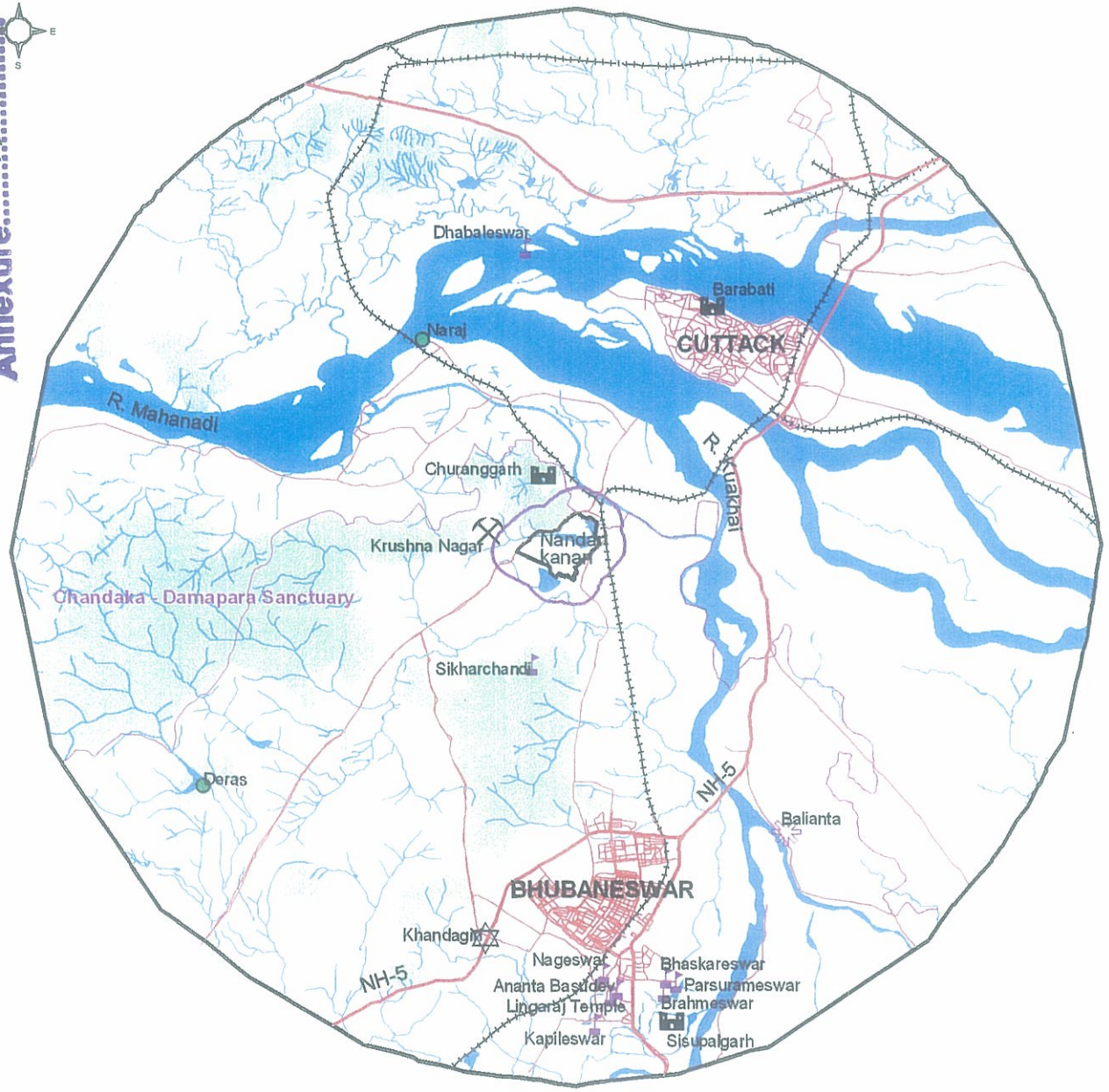
Map showing location of wetlands


Annexure.....V
N
W
E
S
Puri Main Canal
To Trisulia
Klakani Lake
Main Gate
Barang R.S.
Hatimundia Gate
Kanjia Lake
Deer Park
Cattle Bridge
Toy Train
Daya West Canal
Lion Safari
White Tiger Safari
Jagannath Chhak
Katunghasa pata
To Chandaka
Badabanka pata
To Bhubaneswar
LOCATION OF WETLANDS AROUND NANDANKANAN
0.5 0 0.5 1 Kilometers
LEGEND
Nandankanan Sanctuary Boundary
Canal
Streams/Nalas
Major Roads
Major Internal Road
Other Internal Road
Railway
Lakes/Tanks/Ponds
Swampy/Marshy/Waterlogged Area
NANDANKANAN
Prepared By
Geoenvitech Research & Consultancy Services Pvt. Ltd.
Bhubaneswar, geoenvitech@gmail.com

Annexure-VI

Map showing drainage and cultural landscape around Nandankanan

Annexure.....VI



MAP SHOWING DRAINAGE AND CULTURAL LANDSCAPE AROUND NANDANKANAN

4 0 4 8 Kilometers

LEGEND

- Fort
- Temples
- Budhist Heritage
- Jaina Heritage
- Tribal Heritage
- Other Tourist Places
- 1 Km. Buffer Zone
- Core Zone (Sanctuary)
- District Boundary
- Streams/Nalas
- National Highway
- Major Roads
- Railway
- Rivers/Water Bodies
- R.F./P.F.

NANDANKANAN

Prepared By
Geoenvitech Research & Consultancy Services Pvt. Ltd.
Bhubaneswar, geoenvitech@gmail.com

Annexure-VII

Maps

a. Nandankanan Zoological Park (Scale – 1:2000), 1981

b. Map of Nandankanan sanctuary showing location of Conservation Breeding Center for White backed Vulture (Scale – 1:7500)

Annexure-VIII

Layout map of Nandankanan

(Scale 1:3000) showing 2 m. contour interval

Annexure-X

Inventory of existing captive animals in the NKZP

ANNEXURE- X

INVENTORY OF EXISTING CAPTIVE ANIMALS IN NKZP

Sl. No.	Species	Scientific name	Existing animals			
Mammals			M	F	U	Total
1	African red patas monkey	*Erythrocebus patas*	0	1	0	1
2	Assamese macaque	*Macaca assamensis*	1	0	0	1
3	Barking deer / Muntjac	*Muntiacus muntjak*	16	16	4	36
4	Blackbuck / Indian antelope	*Antilope cervicapra*	4	4	0	8
5	Blue bull /Nilgai	*Boselaphus tragocamelus*	4	11	7	22
6	Bonnet macaque	*Macaca radiata*	4	4	2	10
7	Brow-antlered deer / Sanghai / Thamin deer	*Cervus eldi*	0	1	0	1
8	Chimpanzee	*Pan troglodytes*	1	2	0	3
9	Common mongoose	*Herpestes edwardsi*	1	1	0	2
10	Common palm civet / Toddy cat	*Paradoxurus hermaphroditus*	3	3	0	6
11	Fourhorned antelope / Chousingha	*Tetracerus quadricornis*	1	0	0	1
12	Grant's zebra	*Equus burchellii bohmi*	1	3	0	4
13	Great Indian onehorned rhinoceros	*Rhinoceros unicornis*	1	0	0	1
14	Guinea pig	*Cavea porcellus*	3	4	15	22
15	Hamadryas baboon	*Papio hamadryas*	1	2	1	4
16	Himalayan black bear	*Selenarctos thibetanus*	2	2	0	4
17	Hippopotamus	*Hippopotamus amphibius*	3	6	3	12
18	Hog-deer	*Axis porcinus*	2	2	4	8
19	Indian elephant	*Elephas maximus*	1	4	0	5
20	Indian pangolin	*Manis crassicaudata*	2	2	3	7
21(a)	Indian porcupine	*Hystrix indica*	1	1	0	2
21(b)	Indian porcupine (albino)	*Hystrix indica*	0	1	0	1
22	Indian wild boar	*Sus scrofa*	0	1	0	1
23	Jackal	*Canis aureus*	1	1	0	2
24	Leopard / Panther	*Panthera pardus*	2	2	0	4
25	Lion (Hybrid)	*Panthera leo*	14	10	0	24
26	Liontailed macaque	*Macaca silenus*	1	0	0	1
27	Mithun	*Bos frontalis*	1	2	0	3
28	Mouse-deer	*Tragulus meminna*	1	0	0	1
29	Nilgiri langur	*Presbytis johni*	1	0	0	1
30	Orangutan	*Pongo pygmaeus*	0	1	0	1
31	Ratel / Honey badger	*Mellivora capensis*	1	1	0	2
32	Rhesus macaque	*Macaca mulatta*	3	0	0	3
33	Sambar	*Cervus unicolor*	4	2	3	9
34	Sloth bear	*Melursus ursinus*	6	4	0	10
35	Small Indian civet	*Viverricula indica*	1	0	0	1
36	Spotted deer / Chital	*Axis axis*	172	154	0	326
37	Squirrel monkey	*Saimiri sciureus*	0	1	0	1

38	Striped hyena	*Hyaena hyaena*	1	2	0	3
39	Swamp deer/Barasingha	*Cervus duvauceli*	1	4	6	11
40(a)	Tiger	*Panthera tigris*	3	9	3	15
40(b)	White tiger	*Panthera tigris*	5	3	1	9
Birds						
41	Alexandrine / Large Indian parakeet	*Psittacula eupatria*	2	3	2	7
42	Barn owl	*Tyto alba*	1	1	6	8
43	Bengali finch / White backed munia	*Lonchura striata*	1	1	0	2
44	Black ibis	*Pseudibis papillosa*	0	0	1	1
45	Black swan	*Cygnus atratus*	1	0	0	1
46	Blackheaded munia	*Lonchura malacca*	2	2	0	4
47	Blossomheaded parakeet	*Psittacula cyanocephala*	0	0	6	6
48	Blue & yellow macaw	*Ara ararauna*	2	0	0	2
49	Brahminy kite	*Haliastur indus*	1	1	1	3
50	Brown eared conure	*Aratinga sp.*	1	1	3	5
51	Brown fish owl	*Bubo zeylonensis*	0	0	1	1
52	Budgerigar	*Melopsittacus undulatus*	60	120	128	308
53	Cassowary	*Casuarius casuarius*	0	2	0	2
54	Cockatiel	*Nymphicus hollandicus*	6	11	16	33
55	Common muscovy duck	*Cairina moschata*	0	0	1	1
56	Common pariah kite	*Milvus migrans*	0	0	3	3
57(a)	Common peafowl	*Pavo cristatus*	2	1	1	4
57(b)	Common peafowl (white)	*Pavo cristatus*	1	3	1	5
58	Diamond dove	*Geopelia cuneata*	2	4	3	9
59	Dove	*Streptopelia sp.*	0	0	2	2
60	Eastern rosella	*Platycercus eximius*	0	1	0	1
61	Emu	*Dromiceus novaehollandiae*	1	0	0	1
62	Fischer's love bird	*Agapornis fischeri*	1	1	11	13
63	Golden pheasant	*Chrysolophus pictus*	0	1	0	1
64	Green winged macaw	*Ara chloroptera*	1	1	0	2
65	Grey heron	*Ardea cinerea*	3	6	3	12
66	Grey pelican / Spotted billed pelican	*Pelecanus philippensis*	1	2	3	6
67	Indian redbreasted parakeet	*Psittacula alexandri*	0	1	0	1
68	Jandaya conure	*Aratinga jandaya*	0	0	1	1
69	Java sparrow	*Padda oryzivora*	6	16	15	37
70	Koel	*Eudynamys scolopacea*	0	1	0	1
71	Lesser adjutant stork	*Leptoptilos javanicus*	0	0	1	1
72	Lesser sulphur crested cockatoo	*Cacatua slphurea*	1	1	0	2
73	Little egret	*Egretta garzetta*	0	0	1	1
74	Long tailed finch	*Poephila cincta*	1	1	0	2
75	Mandarin duck	*Aix galericulata*	1	1	0	2
76	Median / Small egret	*Egretta intermedia*	0	0	1	1
77	Nicobar pigeon	*Caloenas nicobarica*	1	0	0	1
78	Night heron	*Nycticorax nycticorax*	0	0	4	4
79	Openbill stork	*Anastomus oscitans*	0	1	0	1

80	Painted stork	*Mycteria leucocephala*	0	0	1	1
81	Purple capped lorry	*Lorius domicellus*	0	1	0	1
82	Roseringed parakeet	*Psittacula krameri*	10	18	0	28
83	Rosy / white pelican	*Pelecanus onocrotalus*	1	1	3	5
84	Saurus crane	*Grus antigone*	0	0	2	2
85	Silver pheasant	*Lophura nycthemera*	2	3	0	5
86	Spoonbill	*Platalea leucorodia*	0	1	0	1
87	Spotted munia	*Lonchura punctulata*	2	2	0	4
88	Star finch	*Poephila ruficauda*	1	0	0	1
89	White Chinese dove	*Columbidae sp.*	1	1	1	3
90	White ibis	*Threskiornis aethiopica*	20	40	24	84
91	White scavenger vulture / Pharaoh's chicken / Egyptian vulture	*Neophron percnopterus*	0	0	1	1
92	Whitenecked stork	*Taeniopygia castanotis*	1	0	0	1
93	Yellow backed Lorry	*Lorius garrulus flavopalliatus*	1	0	0	1
94	Zebra finch	*Poephila guttata*	30	50	33	113
Reptiles						
95	Banded krait	*Bungarus fasciatus*	0	0	1	1
96	Binocellate cobra	*Naja naja*	0	0	2	2
97	Burmese rock python	*Python molurus bivistatus*	0	0	1	1
98	Common Indian krait	*Bungarus caeruleus*	0	0	1	1
99	Common Indian monitor lizard	*Varanus bengalensis*	1	1	2	4
100	Common rat snake / Dhaman	*Ptyas mucosus*	0	0	1	1
101	Common sand boa	*Eryx conicus*	1	1	1	3
102	Ganges soft shelled turtle	*Trionyx gangeticus*	0	0	1	1
103	Gharial	*Gavialis gangeticus*	8	14	28	50
104	Indian chameleon	*Chamaeleon zeylanicus*	0	0	2	2
105	Indian mud / Flap-shelled turtle	*Lissemys punctata punctata*	2	2	16	20
106	Indian rock python	*Python molurus molurus*	1	1	0	2
107	Indian starred tortoise	*Geochelone elegans*	2	1	0	3
108	King cobra / Hamadryad	*Ophiophagus hannah*	0	0	1	1
109	Monocellate cobra	*Naja Naja kaouthia*	1	1	1	3
110	Morelet's crocodile	*Crocodylus moreletii*	2	0	0	2
111	Mugger/ Marsh crocodile	*Crocodylus palustris*	0	0	3	3
112	Red sand boa	*Eryx johnii*	1	1	0	2
113	Reticulated python	*Python reticulatus*	0	0	1	1
114	Russell's viper	*Vipera ruselli*	1	0	0	1
115	Salt-water / Estuarine crocodile	*Crocodylus porosus*	0	0	3	3
116	Siamese crocodile	*Crocodylus siamensis*	1	1	0	2
117	Spectacled caiman	*Caiman crocodilus crocodilus*	1	1	2	4
118	Water monitor lizard	*Varanus salvator*	1	1	2	4

Annexure-XI

Checklist of Free-living wild animals in NKZP

ANNEXURE-XI

CHECKLIST OF FREE LIVING WILD ANIMALS IN NKZP

BIRDS

Family:PHALACROCORACIDAE

1 Little Cormorant (*Phalacrocorax niger*)- VC
2 Darter or Snake-bird (*Anhinga rufa melanogaster)*-VR
3 Pond Heron (*Ardeola grayii)*-C
4 Cattle Egret (*Bubulcus ibis coromandus)*-VC
5 Smaller or Median Egret (*Egretta intermedia)*-R
6 Little Egret (*Egretta garzetta)*-VC
7 Night Heron (*Nycticorax nycticorax)*-C
8 Bittern (*Botaurus stellaris)*-VR
9 Painted Stork (*Mycteria leucocephala)*-VR
10 Openbill Stork (*Anastomus oscitans*)-VC

Family:THRESKIORNITHIDAE

11 White Ibis (*Threskiornis aethiopica melanocephala)*-R

Family:ANATIDAE

12 Lesser Whistling Teal or Tree Duck (*Dendrocygna javanica)*-VR

Family: ACCIPITRIDAE

13 Pariah Kite (*Milvus migrans govinda)*-VR
14 Shikra (*Accipiter badius dussdumderi)*-R

Family: PHASIANIDAE

15 Grey Patridge (*Francolinus pondicerianus)*-C
16 Common Peafowl (*Pavo cristatus)*-VC
17 Red Jungle fowl (*Gallus gallus murghi)*-R

Family:RALLIDAE

18 Purple Moorhen (*Porphyrio porphyrio)*-R
19 White breasted Waterhen (*Amaurornis phoenicurus boliocephalus*)-C

Family:JACANIDAE

20. Bronze winged Jacana (*Metopidius indicus)*-C
21. Pheasant-tailed Jacana (*Hydrophasianus chirurgdus)*-R

Sub Family:SCOLOPACINAE.

22 Curlew (*Numenius aurquata)*-VR

Family:BURHINIDAE.

23 Indian Stone Curlew (*Burhinus oedicnemus indicus)*-VR

Family:COLUMBIDAE.

24 Indian Blue Rock Pigeon (*Columba livia intermedia)*-C
25 Indian Spotted Dove (*Streptopelia chinensis)*-VC

Family:PSITTACIDAE.

26 Roseringed Parakeet (*Psittacula krameri)*-VR

Family:CUCULIDAE.

27 Indian Koel (*Eudynamys scolopacea)*-VC

28 Common Crow-Pheasant or Coucal (*Centropus sinensis)*-VC

Family:STRIGIDAE.

Subfamily:STRIGINAE.

29 Eastern Spotted Scops Owl (*Otus spiloephalus)*-VR

30 Barn Owl (*Tyto alba)*-VC

Family:CAPRIMULGIDAE.

31 Indian Jungle Nightjar (*Caprimulgus indicus)*-C

Family:ALCEDINIDAE.

32 Lesser Pied Kingfisher (*Ceryle rudis)*-VR

33 Indian Small Blue Kingfisher (*Alcedo atthis bengalensis)*-VR

34 Eastern White breasted Kingfisher (*Halcyon smyrnensis perpulchra)*-C

Family:MEROPIDAE.

35 Indian Small Green Bee-eater (*Merropos orientalis)*-C

Family:CORACIIDAE.

36 Indian Roller or Blue Jay (*Coracias benghalensis)*-C

Family:UPUPIDAE.

37 Common Hoopoe (*Upupa epops)*-R

Family:MEGALÀIMIDAE

38 Small Green Barbet (*Megalaima viridis)*-R

Family:PICIDAE.

Subfamily:PICINAE.

39 Yellow fronted Pied or Mahratta Woodpecker (*Picoides mahrattensis)*-R

40 Larger Golden backed Woodpecker (*Chrysocolaptes lucidus)*-C

Family:ORIOLIDAE.

41 Indian Golden Oriole (*Oriolus oriolus kundoo)*-C

42 Indian Black headed Oriole (*Oriolus xanthornus)*-C

Family:DICRURIDAE.

43 Indian Black Drongo (*Dicrurus macrocercus)*-VC

44 Indian Whitebellied Drongo (*Dicrurus caerulescens)*-R

Family:STURNIDAE.

45 Blackheaded or Brahminy Myna (*Sturnus pagodarum)*-R

46 Indian Pied Myna (*Sturnus contra)*-R

47 Indian Myna (*Acridotheres tristis)*-VC

Family:CORVIDAE.

48 Northeastern Tree Pie (*Dendrocitta vagabunda)*-VC

49 Indian House Crow (*Corvus splendens)*-VC

50 Indian Jungle Crow (*Corvus macrorhynchos culminates)*-VR

Family:CAMPEPHAGIDAE
51 Large Cuckoo-shrike (*Coracina novaehollandiae)*-R

Family:PYCNONOTIDAE.
52 Bengal Red whiskered Bulbul (*Pycnonotus jocosus)*-R
53 Orissa Red vented Bulbul (*Pycnonotus cafer)*-C

Family:MUSCICAPIDAE.
Subfamily:TIMALIINAE.
54 Striated Babbler (*Turdoides subrufus)*-R
55 Orissa Jungle Babbler (*Turdoides striatus orissae)*-VC

Subfamily:MUSCICAPINAE.
56 Indian Paradise Flycatcher (*Terpsiphone paradisi)*-R

Subfamily: SYLVIINAE
57 Indian Tailor Bird (*Orthotomus sutorius)*-VR
58 Yellow Browed Leaf Warbler (*Phylloscopus inornatus)*-R

Subfamily:TURDINAE
59 Indian Magpie Robin (*Copsychus saularis)*-C

Family:MOTACILLIDAE
60 Indian White Wagtail (*Motacilla alba)*-R
61 Forest Wagtail (*Motacilla indica)*-VR

Family: NECTARINIIDAE
62 Indian Purplerumped Sunbird (*Nectarinia zeylonica sola)*-R
63 Indian Purple Sunbird (*Nectarinia asiatica)*-C

Family: ZOSTEROPIDAE
64 Indian White-eye (*Zosterops palpebrosa)*-R

Family:PLOCEIDAE
Subfamily: PLOCEINAE
65 Indian Baya (*Ploceus philippinus)*-VR

List of Avifauna in Kanjia lake

1. *Phalocrocorax niger* (Little Cormorant)
2. *Ardeola grayii* (Pond heron)
3. *Nycticorax nicticorax* (Night heron)
4. *Egretta intermedia* (Median egret)
5. *Egretta garzetta* (Little egret)
6. *Bubulcus ibis* (Cattle egret)
7. *Anastomus oscitans* (Openbill stork)
8. *Dendrocygna javanica* (Lesser whistling teal)

9. *Tadornat ferruginea* (Brahmini duck)
10. *Anas crecca* (Common teal)
11. *Anas acuta* (Pintail)
12. *Anas poecilorhyncha* (Spotbilled or Grey duck)
13. *Metopidius indicus* (Bronzwinged jacana)
14. *Hydrophasianus chirurgus* (Pheasent tailed jacana)
15. *Porphyrio porphyrio* (Indian purple moorhen)
16. *Amaurornis phoenicurus* (White breasted water hen)
17. *Milvus migrans* (Pariah kite)
18. *Upupa epops* (Hoopoe)
19. *Francolinus pondicerianus* (Grey patridge)
20. *Pavo cristatus* (Peafowl)
21. *Columba livia* (Blue rock pigeon)
22. *Streptopelia chinensis* (Spotted Dove)
23. *Centropus sinensis* (Crow pheasant)
24. *Turdoides straiatus* (Jungle babler)
25. *Orthotomus sutorius* (Tailor bird)
26. *Acridothres tristis* (Common mynah)
27. *Coracias bengalensis* (Indian roller)
28. *Paddy bird-Ardeola grayii* (Pond heron)
29. *Nyctricorax nyctricorax* (Night heron)
30. *Botaurus stellaris* (Bittem)
31. *Numenius arquata* (Curlew)
32. *Psittacula krameri* (Rose ringed parakeet)
33. *Cuculus micropterus* (The Cuckoo)
34. *Tyto alba* (Barn owl)
35. *Caprimulgus indicus* (Nightjar)
36. *Oriolus xanthornus* (Black headed Oriole)
37. *Oriolus oriolus* (Golden Oriole)
38. *Alcedo atthis* (Common Kingfisher)
39. *Ceryle rudis* (Lesser pied Kingfisher)

MAMMALS

1. Wild Boar *(Sus scrofa)*-R
2 Spotted Deer *(Axis axis)*-VC

3 Ratel *(Mellivora capensis)*-R
4 Common mongoose *(Herpestes edwardsi)*-VC
5 Indian Poprcupine *(Hystrix indica)*-R
6 Mouse Deer or Indian Chevrotain *(Tragulus meminna)*-R
7 Common palm civet *(Paradoxurus hermaphroditus)*-R
8 Jackal *(Canis aureus)*-R
9 Indian fox *(Vulpes bengalensis)*-VR
10 Common Langur *(Presbytis entellus)*-VC
11 Rhesus Macaque *(Macaca mulatta)*-VC
12 Jungle Cat *(Felis chaus)*-R
13 Pangolin *(Manis crassicaudata)*-VR

REPTILES

1 Land Monitor lizard *(Varanus bengalensis)*-VC
2 Indian Python *(Phython molurus)*-VC
3 Yellow monitor lizard *(Varanus falvescens)*-R
4 Russels Viper *(Daboia russelli)*-C
5 Banded krait *(Bungarus fasciatus)*-R
6 Common Indian Krait *(Bungarus caeruleus)*-VC
7 Indian Cobra Binocellate *(Naja naja naja)*-VC
8 Cobra Monocellate *(Naja naja kaouthia)*-C
9 Rat Snake *(Ptyas mucosus)*-VC
10 Common Indian Broze-back or tree snake *(Dendrelaphis tristis)*-C
11 Checkered keel back *(Xenochrophis piscator)*-R
12 Chameleon *(Chameleon zeylanicus)*-C
13 Common Green Whip Snake (*Ahaetulla nasuta*)-R
14 Earth Boa *(Eryx johnii)*-VR
15 Garden lizard (*Calotes verricolor*)-VR

STATUS
VR- Very Rare
R- Rare
VC- Very Common
C- Common

List of Reptiles in Kanjia lake

1. *Varanus bengalensis* (Land Monitor lizard)
2. *Python molurus* (Indian python)
3. *Varanus flavescens* (Yellow monitor lizard)
4. *Vipera russelli* (Russell's Viper)
5. *Bungarus fasciatus* (Banded krait)
6. *Naja naja* (Indian cobra {Binocellate})
7. *Naja naja kaouthia* (Monocellate)
8. *Ptyas mucosus* (Rat snake)
9. *Dendrelaphis tristis* (Broze backed tree snake)

10. *Xenochrophis piscator* (Checked keel back)
11. *Bungarus caeruleus* (Common Indian krait)
12. *Chameleon zeylanicus* (Indian Chameleon)
13. *Ahaetulla nasutus* (Common Green Vine snake)
14. *Eryx johnii* (Brown sand boa)

List of fishes

Sl. No.	Scientific name	Local name/English name
1.	*Labeo rohita*	Rohi
2.	*Labeo calbasu*	Kalabainsi
3.	*Catala catala*	Bhakura
4.	*Cirrhinus mrigala*	Mirikali
5.	*Labeo gonius*	Khursia
6.	*Labeo bata*	Rajapohala
7.	*Puntius sarana*	Serena
8.	*Puntius ticto*	Kerandi
9.	*Puntius sophore*	Chepta kerandi
10.	*Puntius chola*	Pita kerandi
11.	*Cirrhinus reba*	Chhunchia pohala
12.	*Wallago attu*	Balia
13.	*Channa striatus*	Seula
14.	*Channa marulius*	Sala
15.	*Channa punctata*	Gadisa
16.	*Channa gachhua*	Chenga
17.	*Notopterus chitala*	Chitala
18.	*Notopterus notopterus*	Fail
19.	*Clarius batrachus*	Magura
20.	*Heteropneustes fossilis*	Singhi, Rata
21.	*Anabas testudineus*	Kau
22.	*Mystus vittatus*	Kantia
23.	*Ompok pabda*	Pobata. Poba
24.	*Glossogolius biocellatus*	Neuli
25.	*Glossogobius giuris giuris*	Baligarada
26.	*Mastacembelus armatus*	Bommy
27.	*Mastacembelus pancalus*	Todi
28.	*Cyprinus carpio*	Bilatirohi
29.	*Ctenopharyngodon indella*	Graascrap
30.	*Anguilla bengalensis*	Lamba bommy
31.	*Xenentodon canceila*	Duithantia gania
32.	*Osteobrama cotis*	Chandi
33.	*Nandus nandus*	Vutasi/Olua
34.	*Chela laubuca*	Khankarakhai
35.	*Gadusia chapra*	Makandi
36.	*Ailia coila*	Baunsa patri
37.	*Amblypharyngodon mola*	Mahurali
38.	*Oxygaster bacaila*	Jaradi

39.	*Esomus danrica*	Dandikiri
40.	*Chanda nama*	Guachippi
41.	*Aplocheilus panchax*	Chariakhia
42.	*Rasbora danoconius*	Black-line Rasbora
43.	*Colisa fasciatus*	Giant Gourami
44.	*Lepidocephalus irrota*	Lokak loach
45.	*Pseudambassis ranaa*	Indian Glassy fish
46.	*Tetradon cuticutia*	Ocellated Pufferfish

Prawns

1.	*Macrobrachium rosenbergii*	Golda
2.	*Macrobrachium malcolmsonii*	Nai chingudi
3.	*Macrobrachium rude*	Nai chingudi

CHECKLIST OF THE FREE LIVING BUTTERFLIES OF NANDANKANAN ZOOLOGICAL PARK

Sl. No.	ENGLISH NAME	SCIENTIFIC NAME	STATUS
	FAMILY PAPILIONIDAE		
1	COMMON ROSE	*Pachliopta aristolochiae*	C
2	CRIMSON ROSE	*Pachliopta hector*	C
3	COMMON JAY	*Graphium doson*	R
4	TAILED JAY	*Graphium agamemnon*	O
5	COMMON MIME	*Papilio clytia*	R
6	LIME	*Papilio demoleus*	VC
7	COMMON MORMON	*Papilio polytes*	VC
8	SPOT SWORDTAIL	*Graphium nomus*	O
9	COMMON BANDED PEACOCK	*Papilio crino*	O
10	BLUE MORMON	*Papilio polymnestor*	O
	FAMILY PIERIDAE		
11	COMMON EMIGRANT	*Catopsilia pomona*	VC
12	MOTTLED EMIGRANT	*Catopsilia pyranthe*	C
13	SMALL GRASS YELLOW	*Eurema brigitta*	R
14	COMMON GRASS YELLOW	*Eurema hecabe*	VC
15	SPOTLESS GRASS YELLOW	*Eurema laeta*	C
16	COMMON JEZEBEL	*Delias eucharis*	O
17	PSYCHE	*Leptosia nina*	VC
18	PIONEER	*Belenois mesentina*	C
19	COMMON GULL	*Cepora nerissa*	VC
20	COMMON ALBATROSS	*Appias albina*	O
21	STRIPED ALBATROSS	*Appias libythea*	C
22	WHITE ORANGE TIP	*Ixias marianne*	C
23	YELLOW ORANGE TIP	*Ixias pyrene*	C
24	SMALL SALMON ARAB	*Colotis amata*	I
25	SMALL ORANGE TIP	*Colotis etrida*	I
26	COMMON WANDERER	*Pareronia valeria*	C
	FAMILY NYMPHALIDAE		

27	COMMON EVENING BROWN	*Melanitis leda*	O
28	COMMON PALMFLY	*Elymnias hypermenstra*	O
29	COMMON BUSHBROWN	*Mycalesis perseus*	O
30	DARK BRANDED BUSHBROWN	*Mycalesis mineus*	R
31	NIGGER	*Orsotriaena medus*	O
32	COMMON FOURRING	*Ypthima huebneri*	O
33	COMMON NAWAB	*Polyura athamas*	R
34	TAWNY COSTER	*Acraea violae*	VC
35	COMMON LEOPARD	*Phalanta phalantha*	C
36	COMMON SAILER	*Neptis hylas*	VC
37	COMMON SERGEANT	*Athyma perius*	R
38	COMMANDER	*Limenitis procris*	O
39	COMMON BARON	*Euthalia aconthea*	O
40	ANGLED CASTOR	*Ariadne ariadne*	O
41	YELLOW PANSY	*Junonia hierta*	VC
42	BLUE PANSY	*Junonia orithya*	O
43	LEMON PANSY	*Junonia lemonias*	VC
44	PEACOCK PANSY	*Junonia almana*	O
45	GREY PANSY	*Junonia atlites*	O
46	CHOCOLATE PANSY	*Junonia iphita*	VC
47	GREAT EGGFLY	*Hypolimnas bolina*	C
48	DANAID EGGFLY	*Hypolimnas misippus*	O
49	GLASSY TIGER	*Parantiça aglea*	O
50	BLUE TIGER	*Tirumala limniace*	R
51	PLAIN TIGER	*Danaus chrysippus*	C
52	STRIPED TIGER	*Danaus genutia*	C
53	COMMON INDIAN CROW	*Euploea core*	VC
	FAMILY LYCAENIDAE		
54	COMMON PIERROT	*Castalius rosimon*	VC
55	STRIPED PIERROT	*Tarucus nara*	O
56	ZEBRA BLUE	*Leptotes plinius*	O
57	QUAKER	*Neopithecops zalmora*	O
58	PALE GRASS BLUE	*Psuedozizeeria maha*	O
59	LESSER GRASS BLUE	*Zizina otis*	O
60	LIME BLUE	*Chilades laius*	O
61	GRAM BLUE	*Euchrysops cnejus*	O
62	PEA BLUE	*Lampides boeticus*	O
63	TINY BLUE	*Zizula hylax*	C
64	COMMON CERULEAN	*Jamides celeno*	C
65	LINE BLUE SP.	*Nacaduba sp.*	O
66	LEAF BLUE	*Amblypodia anita*	C
67	COMMON SILVERLINE	*Spindasis vulcanus*	VC
68	CLUB SILVERLINE	*Spindasis syama*	C
69	SLATE FLASH	*Rapala manea*	C
70	SUNBEAM	*Curetis thetis*	C
	FAMILY HESPERIIDAE		

71	INDIAN SKIPPER	*Spialia galba*	O
72	COMMON SMALL FLAT	*Sarangesa dasahara*	O
73	BUSH HOPPER	*Ampittia dioscorides*	C
74	GOLDEN ANGLE	*Caprona ransonnetti*	I
75	INDIAN/CEYLON ACE	*Halpe homolea*	O
76	CHESTNUT BOB	*Iambrix salsala*	O
77	RESTRICTED DEMON	*Notocrypta curvifascia*	R
78	GRASS DEMON	*Udaspes folus*	R
79	INDIAN PALM BOB	*Suastus gremius*	R
80	TREE FLITTER	*Hyarostis adrastus*	C
81	COMMON REDEYE	*Matapa aria*	C
82	GIANT REDEYE	*Gangara thyrsis*	R
83	COMMON GRASS DART	*Taractrocera maevius*	O
84	RICE SWIFT	*Borbo cinnara*	O
85	SMALL BRANDED SWIFT	*Pelopidas mathias*	C
	STATUS		
	VC=Very common		
	C=Common		
	O=Occasional		
	R=Rare		
	I=Indeterminate		

Annexure-XII

Flora of NKZP

ANNEXURE-XII

FLORA OF NKZP

Annonaceae	: One species of polyalthia
Menispermaceae	: One species each of cissampelos, cocculus and Tinospora
Nymphaeaceae	: Two species of Nymphaea
Nelumbonaceae	: One species each of Nelumbo and Nelumbium
Capparaceae	: Three sps. Of capparies and one sps. of cleome
Violaceae	: One sps. each of Hybanthus and Lonidium
Flacourtiaceae	: One sps. of Casearia and two sps. of Flacourtia
Polygalaceae	: One species of polygala
Caryophillaceae	: One sps. Polycarpaea and two sps. of polycarpon.
Portulacaceae	: Two sps. of portulaca
Elatinaceae	: One sps. of Bergia
Malvaceae	: One sps. of Abutilon, one sps. of Hibiscus, two sps. of sida and two sps. of Urena
Bombacaoeae	: One sps. of Bombax
Sterculiaceae	: One sps. of Helicteres, one sps. of Melochia and two sps. of Pterospermum.
Tiliaceae	: Two sps. of Corchorus, four sps. of Grewia and one sps. of Triumfetta
Linaceae	: One species of Hugonia
Malpghiaceae	: One species of Aspidopterys.
Geraniaceae	: One species of Biophytum.
Balsaminaceae	: One species of Hydrocera
Rutaceae	: One speceis of Aegle. one species of Atalantia, one species of Glycosmis, one species of Naringi and two species of Toddalia.
Meliaceae	: One species of Aphanamixis, one species of Ameora and two species of Cipadessa.
Olacaceae	: One species of Olax.
Celastraceae	: One species of Meytenus and one species of Gymnosporia
Vitaceae	: One species of Ampelocissus, one species of vitis, two species of Cayratia, one species of cissus and three species of vitis.
Sapindaceae	: One species of Allophyllus and one species of Lepisanthes.
Anacardiaceae	: One species of Lannea, one species of Odina, one species of Mangifera
Fabaceae	: One species of Abrus, two species of Aeschynomene, two species of Alysicarpus, two species of Butea, one species of Canavalia, one species of Crotalaria, three species of Desmodium. two species of Dolichos, one species of Indigofera, two species of Mucuna, four species of Sesbania, one species of Tephrosia, one species of Teramunus, one species of Zornnia and one species of Vigan.
Caesalpiniaceae	: Three species of Caesalpinia and two species of Cassia.
Mimosaceae	: Two species of Leucaenal, one species of Minosa and two species of Mimosa
Haloragaeae	: One species of Myriophyllum
Combretaceae	: One species of Calycopteris and two species of Combretum.
Myrtaceae	: One species (E.bracteata)
Lycythidaceae	: One species of Barringtonia
Lythraceae	: One species of Ammania and one species of Rotala
Oragraceae	: Two species of Jussiaea and four species of Ludwigia.
Trapaceae	: Two species of Trapa
Passifloraceae	: One species of Passiflora
Cucurbitaceae	: One species of Coccinia, one species of Cephalandra, one species of Diplocyclos, one species of Luffa, one species of Solena, one species of Melothria, one species of mukia and one species of Momordica.
Alzoaceae	: Two species of Glinus and one species of M. stricta

Apiaceae	: One species of Centella and one species of Hydrocotyle
Alangiaceae	: Two species of Alangium
Rubiaceae	: Two species of Borreria, two species of Spermacoce, two species of Canthium, one species of Catunaregam and one species of Randia, one species of Dentella, two species of Ixora, one species of Meyna, one species of Vangueria and two species of Morinda
Asteraceae	: One species of Acanthospermum, one species of Adenostemma, one species of Aeratum, one species of Bidens, one species of Blumea, one species of Chromolaena odorata, one species of Eupatoruim, two species of Eclipta, one species of Emilia, one species of Mikania, one species of Sphaearanthus, one species of Tridax and one species of Vernonia.
Sapotaceae	: One species of Manilkara, one species of Mimusops, one species of Xantolis and one species of Sideroxylon
Ebenaaceae	: Four species of Diospyros
Oleaceae	: One species of Jasminum and one species of Maba
Apocynaceae	: Two species of Carissa, one species of Aganosma and one species of Ichnocarpus
Asclepiadaceae	: Two species of Pergularia and one species of Hemidesmus
Longaniaceae	: One species of Strychnos
Menyanthaceae	: Two species of Nymphoides and two species of Limnanthemum
Hydrophyllaceae	: One species of Hydrolea
Boraginaceae	: One species of Coldenia and one species of Helotropium
Ehretiaceae	: One species of Ehretia
Convolvulaceae	: Two species of Evolvulus, twelve species of Ipomoea, one species of Jacquemontia, one species of Canvolvulus, four species of Merremia
Cuscutaceae	: One species of Cuscuta
Solanaceae	: One species of Datura, one species of Nicotiana and one species of Solanum
Scrophulariaceae	: Seven species of Limnophila, three species of Lindernia and three species of Vandellia
Lentibulariaceae	: Four species of Utricularia
Acanthaceae	: One species of Andrographis, two species of Barleria, two species of Blepharis, two species of Dicliptera, two species of Ecobolium, one species of Eranthemum, one species of Deadelacanthus, one species of Hygrophila, one species of Asteracantha, two species of Justicia, one species of Peristrophe, two species of Phaulopsis, two species of Rungia and one species of Staurogyne.
Verbenaceae	: One species of clerodendrum, one species of Lantana, one species of Phylla, one species of Lippia, two species of Premna, one species of Symphorema and two species of Vitex
Lamiaceae	: One species of Anisochilus, two species of Anisomeles, one species of Hyptis, one species of Leonotis, one species of Leucas and one species of Ocimum.
Nyctaginaceae	: One species of Boerhavia and one species of Pisonia
Amaranthaceae	: One species of Achyranthes, three species of Aerva, three species of Alternanthera, one species of Amaranthus, one species of Celosia, one species of Gomphrena and one species of Pupalia
Polygonaceae	: Four species of Polygonum
Piperaceae	: One species of Peperomia
Lauraceae	: One species of Cassytha and two species of Litesia
Loranthaceae	: One species of Dendrophthoe, one species of Loranthus and one species of Viscum.
Euphorbiaceae	: One species of Acalypha, one species of Antidesma, one species of Bridelia, two species of Croton, one species of Drypetes, one species of Putranjiva, one species of Euphorbia, one species of Micrococca, one species of Claoxylon, three species of Phyllanthus, one species of Suregada, one

	species of Gelonium and one species of Synostemon and one species of Agyneja
Utricaceae	: One species of Eltostema, one species of pilea and two species of Pouzolzia
Ulmaceae	: One sps. of Tremia
Moraceae	: Five species of Ficus, two species of Streblus, one species of Plecospermum and one species of Phyllochamys.
Ceratophyllaceae	: One species of ceratophyllum
Hydrocharitaceae	: One species of Hydrilfa, one species of Nechamandra, one species of Ottelia and one species of Vallisnaria
Orchidaceae	: Two species of spiranhthes and two species of Vanda
Zingiberaceae	: One species of Costus
Agavaceae	: One species of Agave
Dioscoreaceae	: Three species of Doscorea
Liliaceae	: One species of Asparagus and one species of Smilax
Pontederiaceae	: One species of Eichhorinia and two species of Monochoria
Xyridaceae	: One species of Xyris
Commelinaceae	: One species of Amischophacelus, two species of Cyanotis, five species of Commelina, two species of Murdannia and two species of Aneilema
Araceae	: One species of Pistia, one species of Scindapsus and one species of Typhonium
Alismataceae	: One species of Sagittaria
Aponogetonaceae	: One species of Aponogeton
Eriocaulaceae	: One species of Eriocaulon
Cyperaceae	: One species of Bulbostylis, seven species of Cyperus, five species of Fimbristylis, two species of Kyllinga, one species of Mariscus, one species of Pycreus and one species of Scrirpus
Poaceae	: One species of Alloteropsis, one species of Bambusa, one species of Brachiaria, one species of Chloris, one species of Chrysopogon, one species of Cynodon, one species of Bothriochloa, two species of Digitaria, one species of Echinochloa, one species of Eleusine, two species of Elytrophours, three species of Eragrostis, two species of Eriochloa, one species of Hygroryza, two species of Hymenachne, one sps. of Leersis, one sps. of Microchloa, one species of Oplismenus, one species of Oryza, two species of Panicum, one species of Paspalidium, one species of Paspalum, two species of Perotis and one species of Sporobololus.

List of submerged macrophytes in Kanjia lake

1. *Ceratophyllum demersum* Linn.
2. *Hydrilla verticillata* (Linn.F.) Royle
3. *Najas foveolata* A. Br. Ex Magam.
4. *Potamogeton pectinatus* Linn.
5. *Aponogeton natans* (Linn.) Engl. And Krauses
6. *Ottelia allsmoides* (Linn.) Pers.
7. *Vallisneria natans* (Lour.) Hara
8. *Myriophyllum tetrandrum* Roxb.
9. *Limnophila heterophylla* (Roxb.) Benth.

10. *Limnophila indica* (Linn.) Druce

List of floating macrophytes in Kanjia lake

1. *Azolla pinnata* R. Br.
2. *Eichhornia crassipes* (Mart.) Solms.
3. *Nelumbo nufifera* Gaertn.
4. *Nymphaea nouchali* Burm.f.
5. *Nymphaea pubescens* Wild.
6. *Nymphoides hydrophylla* (Lour.) kuntze.
7. *Nymphoides indica* (Linn.) kuntze.
8. *Pistia stratiotes* Linn.
9. *Trapa natanvar*. Bispinosa (Roxb.) Makino
10. *Salvinia cucullata* (Roxb.)
11. *Ipomoea aquatica* Forsk.
12. *Utricularia inflexa var. stellaris* (Linn.F.)P. Taylor
13. *Commelina benghalensis* Linn.
14. *Euryale ferox* Sallsb

List of emergent macrophytes in Kanjia lake

1. *Cyperus platystylis* R.Br.
2. *Cyperus iria* Linn.
3. *Echinochloa stagnina* (Retz.) Beauv.
4. *Hygroryza aristata* (Retz.) Nees ex Wt. and Arn.
5. *Panicum repens* Linn.
6. *Pistia stratiotes* Linn.
7. *Scirpus articulatus* Linn.
8. *Scirpus grossus* Linn.f.
9. *Salvinia cucullata* Roxb.
10. *Typha angustata* Bory & Chaub.
11. *Adenostemma lavenia* (Linn.) kuntze
12. *Aeschynomene aspera* Lin.
13. *Aeschynomene indica* Linn.
14. *Ampelopteris prolifera* (Retz.) Copel.
15. *Amiscophacelus axillaries* (Linn.) R. Rao & Kammathy
16. *Brachiaria ramose* (Linn.) Stapf
17. *Ceratopteris thalictroides* Brong.
18. *Leersia hexandra* Sw.
19. *Ludwigia adscendens* (Linn.) Jara
20. *L. octovalvis* (Jacq.) Raven
21. *L. perennis* Linn.
22. *Oryza rufipogon* Griff.

23. *Panicum repens* Linn.
24. *Polygonum barbatum* Linn.

List of weeds in Nandankanan Zoological Park

1. *Mikania micrantha* (Indian Hempvine)
2. *Sida acuta* (Bajramuli)
3. *Gomphrena celosioidies*
4. *Evolvulus nummularius* (Bichhamalia)
5. *Desmodium gangeticum* (Salaparni)
6. *Euphorbia hirta*
7. *Vernonia cineria*
8. *Scoparia dulcis*
9. *Eclipta prostrata*
10. *Leptochloa chinensis* (Sialalanji Grass)
11. *Ageratum conyzoides*
12. *Parthenium hysterophorus* (Congress grass)
13. *Achyranthes aspera*
14. *Lemna minor*
15. *Ludwigia perennis* (Bana labangi)
16. *Heliotropium indicum* (Hati sundhia)
17. *Boerhavia diffusa* (Patharachata)
18. *Croton bonplandianum* (Gandhi/lanka)
19. *Centella asiatica* (Indian penywort)
20. *Commelina benghalensis*
21. *Ipomea pes-tigridis*
22. *Ottelia alismoides*
23. *Coccinia grandis* (Kainchi kakudi)
24. *Argemone mexicana* (Mexican poppy)
25. *Lantana camara* (Nagairi)
26. *Chromolaena odorata*

Annexure-XIII

Present staffing pattern

ANNEXURE-XIII
PRESENT STAFFING PATTERN

Sl. No.	Name of each category of post	Sanctioned strength	No. of staff in position	No. of vacancy
1.	Director	1	1	-
2.	Deputy Director	1	1	-
3.	Senior Veterinary Officer	1	1	-
4.	Assistant Director	1	1	-
5.	Veterinary Assistant Surgeon	1	1	-
6.	Forest Ranger	8	8	-
7.	Forester	10	8	2
8.	Forest Guard	25	17	8
9.	Head Clerk	1	-	1
10.	Junior Accountant	1	1	-
11.	Senior Clerk	8	6	2
12.	Junior Clerk	8	3	5
13.	Senior Stenographer	1	1	-
14.	Junior Stenographer	1	1	-
15.	Driver (L.V.)	5	4	1
16.	Driver (H.V.)	3	3	-
17.	Fitter-cum-Mechanic	1	-	1
18.	Engine Driver	1	-	1
19.	Livestock Inspector	3	1	2
20.	Guide	1	-	1
21.	Projector Operator	2	-	2
22.	Booking Clerk	3	3	-
23.	Artist-cum-Modeler	1	1	-
24.	Junior Librarian	1	1	-
25.	Khansama	1	-	1
26.	Gangman	2	2	-
27.	Sweeper	11	6	5
28.	Animal Keeper	25	21	4
29.	Office Peon	2	2	-
30.	Mate	2	1	1
31.	Mahunt	3	1	2
32.	Mali	5	4	1
33.	Watchman	7	6	1
34.	Boatman	2	2	-
35.	Ticket Collector	2	2	-
36.	Zoo Watcher	6	6	-
37.	Bunglow Chowkidar	1	1	-
38.	Winch Operator	1	1	-
39.	Office Chowkidar	1	1	-
40.	Cook-cum-Animal Feed Distributor	1	-	1
41.	Welder-cum-Blacksmith	1	-	1
42.	F.E.O.	1	1	-
	Total	**165**	**120**	**45**
43.	EPF labourers	132		

Annexure-XIV

List of building other than enclosures

ANNEXURE-XIV

LIST OF BUILDING OTHER THAN ENCLOSURES

Qr. No.	Plinth Area	Period of construction	Type of building	Roof	Remarks
1	Dismantled				
1(A)	95.42 Sqmt.	2001	Brick wall with RCC roof	RCC	
1(B)	95.42 Sqmt.	2001	Brick wall with RCC roof	RCC	
2	161.67 Sqmt.	1964-65	Pucca	Asbestos	
3	55.72 Sqmt.	1966-67	Pucca	Asbestos	
4	86.34 Sqmt.	1966-67	Pucca	RCC	
5	60.92 Sqmt.	1981	2 RB Twin	RCC	
6	60.92 Sqmt.	1979-80	2 RB Single	RCC	
7	59.22 Sqmt.	1966-67	Pucca	RCC	
8	37.90 Sqmt.	1965-66	Pucca	RCC	
9	37.90 Sqmt.	1965-66	Pucca	RCC	
10	117.75 Sqmt.	1982-83	Pucca	RCC	
11	47.65 Sqmt.	1983-83	Pucca	RCC	
12	47.65 Sqmt.	1982-83	Pucca	RCC	
13	49.09 Sqmt.	1978-79	2R twin	RCC	
14	49.09 Sqmt.	1977-78	2R twin	RCC	
15	57.06 Sqmt.	1977-78	RCC	RCC	
16	39.03 Sqmt.	1977-78	RCC	RCC	
17	34.21 Sqmt.	1975-76	Pucca	Asbestos	
18	34.21 Sqmt.	1975-76	Pucca	Asbestos	
19	34.21 Sqmt.	1975-76	Pucca	Asbestos corrugated sheet	
20	34.21 Sqmt.	1975-76	Pucca	-do-	
21	34.21 Sqmt.	1975-76	Pucca	-do-	
22	34.21 Sqmt.	1975-76	Pucca	-do-	
23	34.85 Sqmt.	1976-77	Pucca	-do-	
24	34.85 Sqmt.	1976-77	Pucca	-do-	
25	34.85 Sqmt.	1976-77	Pucca	-do-	
26	34.85 Sqmt.	1976-77	Pucca	-do-	
27	34.85 Sqmt.	1976-77	Pucca	-do-	
28	34.85 Sqmt.	1976-77	Pucca	-do-	
29	42.27 Sqmt.	1978-79	Pucca	-do-	
30	42.27 Sqmt.	1978-79	Pucca	-do-	
31	42.27 Sqmt.	1978-79	Pucca	-do-	
32	42.27 Sqmt.	1978-79	Pucca	-do-	
33	42.27 Sqmt.	1978-79	Pucca	-do-	
34	42.27 Sqmt.	1978-79	Pucca	-do-	
35 to 44	Dismantled				
45	22.56 Sqmt.		Pucca	RCC	
46	22.56 Sqmt.		Pucca	RCC	
47	57.77 Sqmt.		Pucca	RCC	
48	39.48 Sqmt.		Pucca	RCC	
49	39.48 Sqmt.		Pucca	RCC	
50	39.48 Sqmt.		Pucca	RCC	

51	39.48 Sqmt.		Pucca	RCC	
52	39.48 Sqmt.		Pucca	RCC	
53	31.25 Sqmt.		Pucca	Asbestos	
54	31.25 Sqmt.		Pucca	-do-	
55	31.25 Sqmt.	1987-88	pucca	-do-	
56	31.25 Sqmt.		Pucca	-do-	
57	60.26 Sqmt.		Pucca	-do-	Bachelor barrack
58/1, 58/2	54.68 Sqmt.		Pucca	Thatched	
59	91.88 Sqmt.		Pucca	RCC	
60	91.88 Sqmt.		Pucca	RCC	
61	49.48 Sqmt.		Pucca	Asbestos	
62/1, 62/2	71.42 Sqmt.		Pucca	Asbestos	WFP building
63/1, 63/2	97.09 Sqmt.		Pucca	Asbestos	-do-
Feed mixing centre	192.60 Sqmt.	2001	Pucca	Asbestos	FC-I to FC-V
Barrack No.1	125.00 Sqmt.	1975-76	Pucca	Asbestos	8 rooms Qr.1/1 to 1/8
Barrack No.2	127.75 Sqmt.	1976-77	Pucca	Asbestos	8 rooms Qr.2/1 to 2/8
Barrack No.3	142.05 Sqmt.	1978-79	Pucca	Asbestos	8 rooms Qr.3/1 to 3/8
Barrack No.4	232.12 Sqmt.		Kacha	Thatched	10 rooms Qr.4/1 to 4/10
Barrack No.5	120.15 Sqmt.		-do-	-do-	6 rooms Qr.5/1 to 5/6
Barrack No.6	195.30 Sqmt.		-do-	-do-	8 rooms Qr.6/1 to 6/8

NON RESIDENTIAL BUILDINGS OF NANDANKANAN ZOOLOGICAL PARK

Quarter No.	Plinth area	Year of construction	Type of building	Roof	Remarks
F.R.H.	213.11 Sqmt.	1962-63	Pucca	RCC	
Administrative Building	162.70 Sqmt.	1973-74	Pucca	Asbestos	
Cottage No.I	38.28 Sqmt.	1966-67	Pucca	RCC	
Cottage No.II	38.28 Sqmt.	1966-67	Pucca	RCC	
Cottage No.III	48.28 Sqmt.	1966-67	Pucca	RCC	
Cottage No.IV	38.28 Sqmt.	1966-67	Pucca	RCC	
OTDC canteen	169.11 Sqmt.	1963-64	Pucca	Asbestos	
Store Room Special Project-I	53.0 Sqmt.	1977-78	Pucca	RCC	
Toy Train Booking Counter	16.20 Sqmt.	1971	Pucca	RCC	
Veterinary Hospital	66.30 Sqmt.	1982-83	Pucca	RCC	
Veterinary Operation Theatre	130.75 Sqmt.		Pucca	RCC	
I.C.U.	217.89 Sqmt.		Pucca	RCC	
Post-mortem Hall	46.12 Sqmt.		Pucca	RCC	
Booking Counter-I	13.02 Sqmt.	1973-74	Pucca	RCC	

Booking Counter-II	50.27 Sqmt.	1973-74	Pucca	RCC	
Safari Booking Counter	24.18 Sqmt.		Pucca	RCC	
Electrovan Garage	125.73 Sqmt.		Pucca	Asbestos	
WFP godown (near Gate-II)	106.39 Sqmt.		Pucca	Asbestos	
Awareness center	275.28 Sqmt.		Pucca	Asbestos	
WFP godown (near Gate-I)	91.79 Sqmt.		Pucca	Asbestos	
Library	237.15 Sqmt.		Pucca	Asbestos	
Aquarium	154.84 Sqmt.		Pucca	RCC	
Aquarium Booking	15.71 Sqmt.		Pucca	RCC	
Tourist information center	17.85 Sqmt.		Pucca	RCC	
Information centre near Booking Counter-II	30.59 Sqmt.		Pucca	RCC	
Boat ghat building Booking counter	111.08 Sqmt.	1973-74	Pucca	RCC	
Staff canteen	90.02 Sqmt.	1987-88	Pucca	G.C. sheet	
Security Office	65.01 Sqmt.		Pucca	RCC	
Sale centre of Forest Product	30.59 Sqmt.		Pucca	RCC	
WLCO office	196.40 Sqmt.	1982-83	Pucca	RCC	Habitable
Workshop	167.40 Sqmt.		Pucca	A.C. Sheet	Inhabitable
Zoo Kitchen	46.12 Sqmt.		Pucca	A.C. sheet	Habitable
D.G. Set	47.89 Sqmt.		Pucca	A.C. sheet	Habitable
WLCO office garage	19.43 Sqmt.	2003		G.I. sheet	
New Gate Complex		2005	RCC		
New Aquarium	66.52 Sqmt.	2005	RCC		

Annexure-XV

Notification of Nandankanan Sanctuary

ANNEXURE-XV

NOTOFICATION OF NANDANKANAN SANCTUARY

THE ORISSA GAZETTE, AUGUST 24, 1979/BHADRA 2, 1901 251

FOREST, FISHERIES & A.H. DEPARTMENT
NOTIFICATION
The 3rd August 1979

S.R. O. No. 935/79. In exercise of the powers conferred by section 18 of the Wildlife (Protection) Act, 1972 (53 of 1972), the State Government do hereby declared that the area, limits of which are specified in details in the schedule below including the entire bed of the Kanjia Lake and the swamps, private land and Government land contained between the boundary described below situated in Chandaka P.S. and New Capital P.S. of Bhubaneswar Sub-division of Puri district to be a sanctuary to be known as Nandankanan Sanctuary for the purpose of protection, propagation, development and research on Wildlife with effect from the date of issue of this notification.

SCHEDULE

Puri Forest Division

Puri District

The north eastern boundary of the Sanctuary starts from the Forest check-gate near Barang on the old Ganjam road and follows the boundary of Krishnanagar P.F. from Pillar No. 1 to 18. Then eastern boundary follows a straight line at a bearing of 1070 from Pillar No. 18 and meets the forest road leading to Barang Railway Station at Pillar No. 19. Then it follows the forest road on the outer fringe and meets Nandankanan-Bhubaneswar P.W.D. Road at Pillar No. 20. Then the boundary line follows Nandankanan-Bhubaneswar P.W.D. Road up to Pillar No. 21. From this point the South-Eastern boundary of the Sanctuary goes in a straight line at a bearing of 2440'30" and meets the boundary of Jujhagarh P.F. at Pillar No. 22. Then it again follows a straight line at a bearing of 2120'3" and again meets the boundary of Jujhagarh P.F. at Pillar No. 23. Then the Southern boundary of the Sanctuary follows the boundary of Jujhagarh P.F. and till it meets the old Ganjam road at Pillar No. 57. The north west boundary of the Sanctuary follows the old Ganjam road in the outer fringe till it meets Pillar No. 1 at the forest check-gate on old Ganjam road near Barang.

{No. 20682-8F(W) 160/78}
By order of the Governor
N.C. BEHURIA
Secretary to Government

Annexure-XVI

Constitution of the Society for Management & Development of NKZP

ANNEXURE-XVI
CONSTITUTION OF THE SOCIETY FOR MANAGEMENT & DEVELOPMENT OF NKZP

Government of Orissa constituted the "Society for Management and Development of Nandankanan Zoological Park" on 27th August, 2005 and has been registered under the Registration of Societies Act of 1860 with Registration No. 22073/54 of 2005-2006 dated 27.08.2005, with the following principal objectives.

(a) Complementing, supplementing, strengthening or otherwise expanding the activities of Nandankanan Zoological Park in the cause of in-situ conservation of wildlife captive management of wildlife and eco-tourism and facilitating linkage between ex-situ and in-situ management of wildlife.

(b) To act as platform for open debate, discussion and subscribe to otherwise assist any charitable, benevolent, scientific, national, public or any other institution the object or purpose of which are consistent with or which promotes objects of the society.

(c) To coordinate and liaise with national/international bodies, experts and funding agencies and to receive constitution and funds from Government of India, Central Zoo Authority, State Government or any individual, institute, national or international agencies, any other institution of Central Government or State Government for specific conservation programme, development of eco-tourism amenities of Nandankanan.

(d) To receive and manage all contributions given to the Society in large interest of Nandankanan Zoological Park for maintenance and upkeep of zoo animals, improvement of the premises as well as maintenance and upkeep of zoo animals, improve the premises as well as maintenance and improvement of visitors amenities.

(e) To engage/employ such staff as may be necessary for efficient handling and conduct of business of the society with approval of General Body.

(f) To do all such acts and activities as area incidental or conducive to attainment of the objectives or directly beneficial to the society in promotion of its objects, subject to the overall control of the Chief Wildlife Warden and in conformity with the Society Registration Act, 1860.

(g) To carry out any other activities in the furtherance of the above objectives.

Annexure-XVII

Notification for Constitution of Technical Committee

ANNEXURE-XVII
NOTIFICATION FOR CONSTITUTION OF TECHNICAL COMMITTEE

Government of Orissa
Forest and Environment Department

OFFICE ORDER

Bhubaneswar, Dated the, 19.09.2000

No. 8F(N)12/2000(pt-II) 15036 / F&E., In pursuance to the para 3.21 of the Report of the Central Expert Committee on death of Tigers at Nandankanan Zoo "Communicated vide F.No.12-3/2000-CZA(S) dtd. 22.08.2000 of Central Zoo Authority Govt. have been pleased to constitute the technical committee for the Nandankanan Zoo as follows:

1.	Dr. S.K. RAy, Prof. & H.O.D. Deptt. Of Medicine, Orissa Veterinary College.	-	Chairman
2.	Dr. J.N. Mohanty, Retd.Prof. Surgery, Orissa Veterinary College and Regd. Director, Veterinary Services.	-	Member
3.	Sri Sudhakar Mohapatra, IFS(Rtd) (Former Chief Wildlife Warden, Orissa) At- Indira Gandhi Padia, (Palghat) Khurda-2, Khurda	-	Member
4.	Dr. L.N. Acharjyo, Veterinarian (Rtd) At-MIG-71, Baramunda Housing Colony, Bhubaneswar	-	Member
5.	Conservator of Forests (WL) & Ex-Officio Director, Nandankanan Zoological Park, Bhubaneswar	-	Member Convenor

The Committed shall meet periodically at least once in a month or in crisis situation as may be required.

The Committee will technically advise the Zoo Authority on health care & related technical matters.

The Committee will visit the Zoo as often as required, and shall establish a network with the relevant local institutions so that at all times. The necessary veterinary care assistance may be available to the Zoo.

They may co-opt. any other professionals if they feel necessity for advice or helping the Committee on deliberation and decision.

The members of the Committee shall be entitled to get T.A. & D.A. as applicable to the Grade-A Officers of the Statement Government, for attending the meeting of the Committee & visiting the Zoo at intervals.

The committee should start functioning with immediate effect.

Sd/- H.S. Chahar
Commissioner-cum-Secretary to Govt.

Annexure-XVIII

List of single/unpaired animals

ANNEXURE-XVIII
LIST OF SINGLE/UNPAIRED ANIMALS

Sl. No.	Species	Scientific name	Existing animals			
Mammals			M	F	U	Total
1	African red patas monkey	*Erythrocebus patas*	0	1	0	1
2	Assamese macaque	*Macaca assamensis*	1	0	0	1
3	Brow-antlered deer / Sanghai / Thamin deer	*Cervus eldi*	0	1	0	1
4	Fourhorned antelope / Chousingha	*Tetracerus quadricornis*	1	0	0	1
5	Great Indian onehorned rhinoceros	*Rhinoceros unicornis*	1	0	0	1
6	Indian porcupine (albino)	*Hystrix indica*	0	1	0	1
7	Indian wild boar	*Sus scrafa*	0	1	0	1
8	Liontailed macaque	*Macaca silenus*	1	0	0	1
9	Mouse-deer	*Tragulus meminna*	1	0	0	1
10	Nilgiri langur	*Presbytis johni*	1	0	0	1
11	Orangutan	*Pongo pygmaeus*	0	1	0	1
12	Rhesus macaque	*Macaca mulatta*	3	0	0	3
13	Small Indian civet	*Viverricula indica*	1	0	0	1
14	Squirrel monkey	*Saimiri sciureus*	0	1	0	1
Birds						
15	Black ibis	*Pseudibis papillosa*	0	0	1	1
16	Black swan	*Cygnus atratus*	1	0	0	1
17	Blossomheaded parakeet	*Psittacula cyanocephala*	0	0	6	6
18	Blue & yellow macaw	*Ara ararauna*	2	0	0	2
19	Brown fish owl	*Bubo zeylonensis*	0	0	1	1
20	Cassowary	*Casuarius casuarius*	0	2	0	2
21	Common muscovy duck	*Cairina moschata*	0	0	1	1
22	Common pariah kite	*Milvus migrans*	0	0	3	3
23	Dove	*Streptopelia sp.*	0	0	2	2
24	Eastern rosella	*Platycercus eximius*	0	1	0	1
25	Emu	*Dromiceus novaehollandiae*	1	0	0	1
26	Golden pheasant	*Chrysolophus pictus*	0	1	0	1
27	Indian redbreasted parakeet	*Psittacula alexandri*	0	1	0	1
28	Jandaya conure	*Aratinga jandaya*	0	0	1	1
29	Koel	*Eudynamys scolopacea*	0	1	0	1
30	Lesser adjutant stork	*Leptoptilos javanicus*	0	0	1	1
31	Little egret	*Egretta garzetta*	0	0	1	1
32	Median / Small egret	*Egretta intermedia*	0	0	1	1
33	Nicobar pigeon	*Caloenas nicobarica*	1	0	0	1
34	Night heron	*Nycticorax nycticorax*	0	0	4	4
35	Openbill stork	*Anastomus oscitans*	0	1	0	1
36	Painted stork	*Mycteria leucocephala*	0	0	1	1
37	Purple capped lorry	*Lorius domicellus*	0	1	0	1
38	Saurus crane	*Grus antigone*	0	0	2	2
39	Spoonbill	*Platalea leucorodia*	0	1	0	1

40	Star finch	*Poephila ruficauda*	1	0	0	1
41	White scavenger vulture / Pharaoh's chicken / Egyptian vulture	*Neophron percnopterus*	0	0	1	1
42	Whitenecked stork	*Taeniopygia castanotis*	1	0	0	1
Reptiles						
43	Banded krait	*Bungarus fasciatus*	0	0	1	1
44	Binocellate cobra	*Naja naja*	0	0	2	2
45	Burmese rock python	*Python molurus bivistatus*	0	0	1	1
46	Common Indian krait	*Bungarus caeruleus*	0	0	1	1
47	Common rat snake / Dhaman	*Ptyas mucosus*	0	0	1	1
48	Ganges soft shelled turtle	*Trionyx gangeticus*	0	0	1	1
49	Indian chameleon	*Chamaeleon zeylanicus*	0	0	2	2
50	King cobra / Hamadryad	*Ophiophagus hannah*	0	0	1	1
51	Mugger/ Marsh crocodile	*Crocodylus palustris*	0	0	3	3
52	Reticulated python	*Python reticulatus*	0	0	1	1
53	Russell's viper	*Vipera ruselli*	1	0	0	1
54	Salt-water / Estuarine crocodile	*Crocodylus porosus*	0	0	3	3

Annexure-XIX

Suggested staffing pattern

ANNEXURE-XIX

SUGGESTED STAFFING PATTERN

ESTABLISHMENT		Director (Conservator of Forests)	1
		Director's Personal Staff- Personal Assistant	1
		- Orderly Peon	2
		- Driver (LV)	1
		Joint Director (Deputy Conservator of Forests)	1
		Joint Director Personal Staff- Jr. Stenographer	1
		- Orderly Peon	2
		- Driver (LV)	1
		Office Superintendent	1
		Accountant	2
		Senior Clerk	4
		Junior Clerk cum computer Assistant	5
		Computer Programmer	1
		Typist-cum-Despatcher	1
		Office Peon	2
		Office Chowkidar	1
SECURITY		Range Officer (Security)- FR	1
		Forester (Security)- Fr	3
		Forest Guards (Security) FG	6
		Zoo Watcher	6
		Zoo Watchman	6
		Ticket Collector	2

Contract Security Guards with Supervisor along with VHF Operator/CCTV Operator from ex-servicemen for night duties as well as for specific location/area duties shall be hired

ANIMAL MANAGEMENT		Curator (Assistant Conservator of Forests)	1
		Assistant Curator (FR)	2
		Forester (Head Animal Keeper)- Fr	4
		Forest Guards (Senior Animal Keeper)- FG	10
		Zoo worker (Animal Keeper)	30
		Zoo attendants (Assistant Animal Keeper)	15
		Mahout (for elephant)	4
		Mate (for elephant)	4
SANITATION		Forester (Sanitation)- Fr	2
		Forest Guards (Sanitation)- FG	4
		Gangman	2
		Zoo Workers (Sanitation)- Sweeper	10
VETERINARY		Senior Veterinary Officer	1
		Veterinary assistant Surgeon	2
		Livestock Inspector	4
		Laboratory Assistant	1
		X-ray Technician	1
		Zoo Attendant (Veterinary)	3
MAINTENANCE	(a)	Building/Roads/Enclosures	
		Assistant Engineer	1
		Supervisor (Works)- Fr	1
		Jr. Clerk	1
		Blacksmith-cum-welder	1

		Electrician	1
		Carpenter	1
		Mason	1
		Plumber	1
		Boatman	2
		Khansama	1
		Bunglow Chowkidar	3
		Zoo Attendants (Maintenance)	3
	(b)	Lawn and Garden	
		Forester (Garden)- Fr	1
		Head Mali	2
		Mali	10
	(c)	Machines	
		Train Engine Driver	1
		Driver (HV)	3
		Driver (LV)	2
		Diesel Generator Set Operator	1
		Pump Operator	2
		Projector Operator	1
		Winch Operator	1
		Gangman	2
		Zoo Attendant (Maintenance)	5
PROCUREMENT & SUPPLY		Forest Ranger	1
		Forester	1
		Forest Guard	2
		Store Keeper- General (Fr)	
		Store Keeper- Feed (Fr)	1
		Jr. Clerk	1
		Zoo attendant	5
EDUCATION		Biologist	2
		Zoo Education Officer	1
		Education Assistant (General section1 & Wildlife-1)	2
		Guide	1
		Computer Analyst	1
		Artist-cum-Modeler	1
		Jr. Librarian	1
		Zoo attendant	2
RESEARCH		Sr. Research Fellow	1
		Jr. Research Fellow	3
		Field Assistant	3
REVENUE		Forest Ranger	1
		Forester	1
		Forest Guard	1
		Ticket Booking Clerk	6
SPECIAL PROJECT		Forest Ranger	1
		Forester	1
		Forest Guard	2
		TOTAL	**241**